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Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—41, Queen's Gate, London, S.W.7.

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HARTZELL (A.). **Further Tests on Plant Products for insecticidal Properties.**—*Contr. Boyce Thompson Inst.* **13** no. 5 pp. 243–252, 1 fig., 24 refs. Menasha, Wis., 1944.

The author describes further investigations on the insecticidal properties of extracts of some 125 species and varieties of plants and of three isolated toxins derived from plants [*cf. R.A.E.*, A **30** 286]. Plants known to contain substances poisonous to man were avoided, with a few exceptions, as it was hoped to find toxins specific to insects. The median lethal doses of acetone extracts of the plants to larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) are shown in tables. They were 24 and 29 parts per million for berries of *Piper cubeba* and dried berries of *P. nigrum* and between 245 and 520 p.p.m. for the nine plants next in order of toxicity. None of these plants gave kills within this dosage range when extracted with water. Acetone extracts of *P. nigrum*, bark of prickly ash (*Zanthoxylum clava-herculis*) and seeds of water-melon (*Citrullus vulgaris*), of which the median lethal doses for the mosquito larvae were 29, 540 and 560 p.p.m. failed to give satisfactory kills of *Aphis rumicis*, L., at concentrations of approximately 4,000 p.p.m. Negative results were also obtained with an acetone extract of *P. nigrum* (1·2 per cent.) emulsified with Penetrol (0·5 per cent.) in water and tested as a stomach poison against adults and larvae of *Epilachna varivestis*, Muls., though satisfactory kills were obtained under experimental conditions in the greenhouse, when the adults were allowed to feed on the foliage of bean plants that had been dusted with black pepper.

It is pointed out that ten of the eleven plant products giving the highest kill of mosquito larvae were obtained from the flowers or fruiting parts of the plants and that the eleven plants are distributed in eight families.

COTTERELL (G. S.). **Entomology.**—*Rep. centr. Cocoa Res. Sta. Tafo 1938–42* pp. 46–55, 2 refs. Accra, 1943.

Work at the Cocoa Research Station at Tafo in 1938–42 on the insect pests and virus diseases that attack cacao in the Gold Coast is summarised. In 1939, *Bryocoropsis laticollis*, Schum. [*cf. R.A.E.*, A **29** 492; **32** 287] was more abundant in the pod-bearing season than either *Sahlbergella singularis*, Hagl., or *Distantiella* (*S.*) *theobroma*, Dist., which attack the pods at a later stage. The mean durations of the egg and nymphal stages of this Capsid on caged pods in the field were 14·7 and 19·2 days. Adult females survived for up to 33 days and laid an average of 64 eggs. Observations on seasonal fluctuations showed that the incidence of *B. laticollis* depends on the number of ripening pods available and that *S. singularis* also increases as the pods ripen, but continues to breed in numbers on the new flush that follows harvesting. The occurrence of *D. theobroma* was irregular. A marked reduction in numbers of *S. singularis* and *D. theobroma* observed during the dry season is attributed to the low humidity and not the high temperature, since adults and nymphs of both species withstood exposure to 90°F. for 48 hours, while a relative humidity of about 60 per cent. appeared to be critical.

Observations in 1926 had indicated that populations of *S. singularis* or *D. theobroma* may be reduced by the predacious ant, *Oecophylla smaragdina longinoda*, Latr. [*cf.* **19** 733], but in 1940, when the percentage of trees per plot infested by the ant varied from 0 to 50, there was no correlation between its presence and damage by the Capsids. Transferring nests of *Oecophylla*, together with mobile forms of Coccids of the genus *Stictococcus*, to heavily infested trees did not reduce the infestation. It is necessary in establishing the ants that the trees should bear young growth on which the young Coccids can become established, and if enough is available for both Coccids and Capsids to complete their development, the ant apparently does not attack the latter. Percentage parasitism by *Euphorus sahlbergellae*, Wlkn., was studied during the year ending March 1941. As judged from the cocoons obtained from caged

nymphs, it was highest in *S. singularis* in March–April (9·5–11·7 per cent.) and in *B. laticollis* in May and January (8 and 7·7 per cent.). Attempts to rear *E. sahlbergellae* on *D. theobroma* in the laboratory were unsuccessful.

In spraying experiments, 100, 100 and 90 per cent. of the Capsids were killed by nicotine sulphate at concentrations of 1 : 1,000, 1 : 1,500 and 1 : 2,000, respectively. Lime sulphur and a proprietary preparation containing tar and petroleum oil distillates were very much less effective at concentrations that caused severe leaf-scorch. Dusts of pyrethrum and a mixture of derris and nicotine were satisfactory in laboratory trials.

Minor pests of cacao observed during the year included *Anomis leona*, Schaus, the larvae of which attack the flowers and newly-set pods, and *Adoretus umbrosus*, F. (*hirtellus*, Lap.) which severely damaged the seedlings.

Experiments were carried out in 1941 on the transmission of the swollen-shoot disease of cacao. Suspected insect vectors from infected plants were placed on healthy year-old seedlings screened with muslin in an insectary, mosaic or chlorosis [*cf.* **32** 337] appeared on plants infested with *Mesohomotoma tessmanni*, Aulm., *Pseudococcus* sp. [? *exitiabilis*, Laing (*cf.* **32** 246)], *Ferrisia* (*Ferrisiana*) *virgata*, Ckll., and *Toxoptera aurantii*, Boy., and swellings developed later on the same plants, except those infested with *Ferrisia*. All the six plants that were infested with nymphs of *Mesohomotoma* developed symptoms, though in one case the disease was non-virulent and there was some accidental infestation by the mealybugs and *Toxoptera*; the minimum period between infestation and the appearance of the symptoms was 38 days. All of three plants infested with *Pseudococcus* and two of five infested with *Ferrisia*, developed symptoms after 187 days or more; and two of six infested with *T. aurantii* developed symptoms, apparently of a non-virulent type, one after 139 days. Symptoms appeared after 509 days in one of six trees that were infested with adults of *Mesohomotoma*, but numerous infestations by mealybugs and one by *Toxoptera* had occurred. The author considers that the results with the nymphs of this Psyllid were conclusive, but that further tests with the other insects were required [*cf.* **32** 26]. Negative results were obtained in tests with 13 other species of Hemiptera and with *Selenothrips rubrocinctus*, Giard.

The egg and nymphal stages of *M. tessmanni* were completed in 4–8 and 7–11 days, respectively. Its incidence is correlated with the amount of young growth and is greatly reduced by heavy rainfall; the immature stages are gregarious. Alternative food-plants include *Cola* spp., *Sterculia tragacantha* and *Glossolepis pilgeriana*. Two endoparasites, both uncommon, attack the immature stages. The egg stage of the mealybugs lasts one day and the time they require for subsequent development varies with the food supply; the maturing females migrate from tree to tree along the ground. Unlike the species of *Pseudococcus*, *F. virgata* is not tended by ants. Colonies of *T. aurantii* occur on the lower surface of the young leaves, and winged females migrate from plant to plant.

An inert dust (Neosyl) applied to dry stored cacao beans at rates of 0·1 and 0·2 per cent. was found after nine months to have been ineffective against *Araecerus* [*fasciculatus*, Deg.], *Ephestia* [*cautella*, Wlk.] and *Lasioderma serricorne*, F.

MARCHIONI (A. H.). **Micropruebas de resistancia a la langosta en el maíz "amargo."** [Small-scale Tests of the Resistance of the Maize Variety Amargo to *Schistocerca paranensis*, Burm.]—*An. Inst. fitotéc. S. Catalina* **1** pp. 159–166, 2 figs., 1 ref. Llavallol, 1939; also as *Publ. Inst. fitotéc. S. Catalina* no. 7, 1940. (With a Summary in English.) [Recd. December 1944.]

The author describes two methods that were developed for testing the resistance of maize varieties and hybrids to attack by *Schistocerca paranensis*,

Burm., in Argentina. By the first method, used for young plants, four rows of the maize to be tested, and one of a common commercial variety for comparison, were sown in cages, and when the plants were about six inches high, some 20 locusts were introduced for periods varying from a few hours in summer to five or more days in winter. After this, the plants were classified on a scale that ranged from resistant (untouched) to susceptible (totally consumed). In a test with the Amargo and Early Amargo varieties of maize [*cf.* next abstract] and a hybrid (Amargo × Cuarentón), Early Amargo and the hybrid showed average resistance, and Amargo appreciable resistance, though the results were not conclusive.

In tests of mature plants, pieces of leaf 4–5 ins. long were set on end in sand, which was watered to keep them fresh, and exposed to the locusts for approximately ten hours. No plants of the hybrid showed such marked resistance as the variety Amargo, but lines with a distinct degree of resistance were found to exist. Amargo showed significantly more resistance than the hybrid, early Amargo or common varieties of maize, and it was possible to select lines of this variety that were completely resistant.

HOROVITZ (S.) & MARCHIONI (A. H.). **Herencia de la resistencia a la langosta en el maíz "amargo."** [The Inheritance of Resistance to *Schistocerca paranensis*, Burm., in the Maize "Amargo."]—*An. Inst. fitotéc. S. Catalina* **2** pp. 27–52, 2 pls., 1 fig., 7 refs. Llavallol, 1940; also as *Publ. Inst. fitotéc. S. Catalina* no. 23, 1942. (With a Summary in English.) [Recd. December 1944.]

Amargo is a local maize that is much less attacked by *Schistocerca paranensis*, Burm., than the common varieties and is cultivated in the regions of Argentina most exposed to locust invasions. The resistance to attack is inherent in the variety and is not affected by conditions of cultivation. Tests of different samples of maize belonging to this variety revealed considerable differences in the reactions of the individual plants, but resistance was always permanent in the descendants of a self-fertilised resistant individual. Tests were therefore made of the resistance of hybrids between such plants and susceptible varieties of maize.

When pieces of leaf were exposed to locusts in small cages [*cf.* preceding abstract], the progeny of Amargo fertilised by a susceptible variety proved to be semi-susceptible (less susceptible than the susceptible parent), and the same was true for the reciprocal crosses. When the F_1 generation was self-fertilised it gave rise to susceptible and resistant individuals in the ratio of 3 : 1. Back crosses of the F_1 generation with Amargo gave rise to equal numbers of resistant and susceptible or semi-susceptible plants. No visible character, such as pigment or hairiness, was found to be correlated with the degree of resistance of the plants.

Identical results were obtained when *S. paranensis* was replaced by other Acridids.

NEISWANDER (C. R.). **The Ring-legged Earwig, *Euborellia annulipes* (Lucas).**—*Bull. Ohio agric. Exp. Sta.* no. 648, 14 pp., 5 figs., 10 refs. Wooster, Ohio, 1944.

Anisolabis (*Euborellia*) *annulipes*, Lucas, all stages of which are described, attacked radishes in one greenhouse in Ohio in the winter of 1936–37 [*R.A.E.*, A **28** 92] and the four succeeding years. The damage was sufficient to warrant control measures in each year, but was severe only in 1937, before the effectiveness of a bait containing Paris green was discovered. Radish was the only plant attacked. The earwig was found in one other greenhouse in Ohio in 1941, but

caused no injury there. Its feeding habits are reviewed from the literature [*cf.* **30** 490], and details are given of its life-history and behaviour in the laboratory and of tests of baits for its control.

In the laboratory, ten females laid 69–186 eggs in clusters of 9–65. The eggs hatched in 10–12 days at a temperature of 75°F. and the life-cycle averaged about four months; various stages were present throughout the year in the greenhouse in which infestation was first observed. The earwigs were found under various kinds of débris, such as old mulch material; they were attacking radishes, but probably also fed on woodlice (as they did under experimental conditions) and crickets, both of which were abundant in the same positions. The bait tests indicated that Paris green was the most effective poison, and it is recommended that a bait of 12 oz. Paris green, 12 lb. bran, 2 U.S. quarts molasses and 6 U.S. quarts water should be broadcast in the evening at the rate of 1 lb. per 4,000 sq. ft.

EYER (J. R.) & SCHNEIDER (G. W.). **Spraying Schedules for Apple Orchards in northern New Mexico.**—*Bull. N. Mex. agric. Exp. Sta.* no. 303, 35 pp., 12 figs., 7 refs. State College, N. Mex., 1943.

Data on which to base the timing of sprays against the codling moth [*Cydia pomonella*, L.] in the important apple-growing area of north-western New Mexico were collected in 1940–42, and accounts of the investigations, together with the recommendations based on them, are given in this bulletin. Observations on the periods of adult emergence, maximum adult activity and maximum oviposition are discussed with reference to the weather conditions during the three years. In general, climatic conditions over the whole area are favourable to the moth, the mean yearly temperature being 50·5°F. and the average total precipitation less than 10 ins. [*cf. R.A.E.*, A **25** 569].

The following is based largely on the authors' summary and conclusions. There is a partial second generation each year in this area; 20–30 per cent. of the first-generation larvae overwinter, the proportion being higher in the north than in the south, where control is accordingly more difficult. The first adults appear in late April or early May in the south and in mid-May in the north, and the interval between the flight periods of the two generations takes place in late June or early July. It is more distinct in the south than in the north, where there is some overlapping. Cover sprays are most effective when applied during peaks of moth activity, one or more of which occur in each generation, and the use of bait pails to time them is recommended. Cool weather, particularly during May and June, delays and prolongs adult emergence and the bait pails often fail to catch the moths in sufficient numbers for proper timing of the first-brood cover sprays. The catches are also reduced when the mean temperature exceeds 75°F. and during periods of heavy rain. The supplementary use of trap bands, which provide a reliable index to rate of pupation and emergence, is therefore suggested. An interval of from 10 to 20 days was observed between the first peak of moth activity in spring and the hatching of eggs, and an interval within this range should elapse between the calyx and the first cover sprays, its duration varying with the mean temperatures of the season. The second cover spray should be applied 10–14 days after the first. The first peak of activity of the summer generation moths occurs 30–45 days after the application of the second cover spray, and this interval is consistent in the southern half of the apple-growing area, where it may be used as a rough criterion for determining the date to apply the first spray against the second generation. The intervals between the sprays against this generation may be rather longer than 10 days, as fruit growth is slower as the season advances. It was found that in most varieties the greatest increase in surface area of the fruit takes place during June and the first week of July, and that in some varieties another marked increase takes place in late July and early August.

It is therefore important that the cover sprays against the first generation and the first two cover sprays against the second should be applied very thoroughly. Six cover sprays are recommended in the southern part of the area, and at least five in the north.

A spray schedule based on these investigations is given, and instructions for the preparation and use of baits and trap bands are also included.

HATFIELD (I.). **Research Tests on Soil-poisoning Chemicals for the Control of Subterranean Termites.**—*Pests* **12** no. 3 pp. 10–14, 8 figs., 6 refs. Kansas City, Mo., 1944.

The author describes investigations carried out in West Virginia, Mississippi and Florida in 1938–43 to test the effect of a number of soil-poisoning chemicals in protecting wood from subterranean termites. Billets of pine were buried in treated soil, examined once a year and then replaced. The results indicate that pentachlorphenol and a mixture of this compound with trichlorbenzene are among the best treatments studied, none of which was completely effective for the five-year period. Several new compounds were of value, but these are not named as they are not available in war time. It was found that for adequate protection, the chemicals must be well distributed throughout the soil; that termite attack occurred in undecayed wood and did not necessarily induce decay, though if conditions were suitable for decay termite attack was likely to occur more readily and progress more rapidly, and termites often made conditions more suitable for decay by carrying soil and humus into the wood; that though shade, poor ventilation and poor drainage encouraged tube building, their absence did not prevent it; and that termites could establish themselves in areas occupied by ants and could work in wood that was partly occupied by them.

WHITEHEAD (F. E.). **Insect Populations of Farm Wheat Bins in Oklahoma and Experiments in their Control.**—*Proc. Okla. Acad. Sci.* **24** pp. 29–34, 5 figs. Guthrie, Okla., 1944.

Insect infestation of wheat stored in farm bins was unusually severe in Oklahoma in 1941, and many farmers reported failures in attempts to control it. An investigation showed that most of these failures were due to the use of an insufficient amount of fumigant, and some to improper methods of application. To obtain more information on the insects present and the effectiveness of carbon bisulphide against them, samples were taken at successive six-inch depths in eleven bins containing wheat to a height of 4–6 ft., before and 48 hours after each bin was fumigated. The only insects found in any numbers were *Laemophloeus minutus*, Ol., *Oryzaephilus surinamensis*, L., *Tenebroides mauritanicus*, L., *Calandra* (*Sitophilus*) *oryzae*, L., and *Rhizopertha dominica*, F.; *L. minutus* was much more abundant than all the other species, and more than 24 times as abundant as *C. oryzae* or *R. dominica*, which are the most injurious. The distribution of the total insect population at the different six-inch levels did not vary in any constant way with the depth, but the number was about three times as great at the surface as at any one depth below it.

The carbon bisulphide was applied by sprinkling or spraying it on the surface of the wheat or pouring it into funnels inserted for a short distance. The rate was 4 U.S. gals. per 1,000 bushels. No advantage was obtained by covering the wheat after treatment, whatever the method of application. The funnel method was very slightly less effective than the others, but it was evident that it would not be safe for anyone working alone to pour the fumigant on the surface of the wheat. The kill of insects was practically uniform at the various depths in the bins, but varied with the species. The percentage mortality was 100 in all

bins for *R. dominica*, about 90 for the three less injurious species and less than 30 for *C. oryzae*, the low figure for which was largely due to its relative abundance in one particular bin in which poor control generally was obtained.

WALTON (R. R.). **Green Bug Injury on Barley Varieties at Woodward, Oklahoma, in 1943.**—*Proc. Okla. Acad. Sci.* **24** pp. 38–42, 1 ref. Guthrie, Okla., 1944.

An investigation of injury by *Toxoptera graminum*, Rond., to 25 varieties of barley was carried out in Oklahoma in 1943. The outbreak was practically over in late April, when the investigation began, but there was evidence that the abundance of the Aphids in the various plots had been uniform. A table shows for each variety the percentage of plants with 75–100 per cent. of the leaves dead owing to Aphid injury, its general vigour, and its rank in order of yield. The figures under the first heading varied with the variety from 12 to 54. The varieties that came first, third and fifth in order of yield were only intermediate in order of Aphid injury or general vigour, and no definite conclusions are drawn, but averages of the results indicated that a greater vigour of the plant was associated with less Aphid injury and a higher yield, and that varieties differed in their ability to recover from injury.

CARPENTER (J. M.). **The Effect of Population Density on the Productivity of the Parasite** *Microbracon mellitor* **Say (Hymenoptera Braconidae).** (Abstract.)—*Proc. Tex. Acad. Sci.* **27** (1943) pp. 69–70. Houston, Tex., 1944.

Bracon (*Microbracon*) *mellitor*, Say, a valuable parasite of *Anthonomus grandis*, Boh., in various cotton growing areas of the United States, usually lays a single egg on the paralysed host larva. Single fertilised females kept for 72 hours in a volume of 420 cc. at 85°F. with 20 larvae on which to oviposit yielded an average of 7·5 adult offspring each. When batches of 5, 10, 15, 30 and 60 were kept under the same conditions, their individual productivity decreased to 2·85, 1·92, 1·47, 0·74 and 0·41, respectively. This decrease is believed to be due partly to competition among the parasites and partly to their laying fewer eggs because they have to spend a longer time in searching for unparasitised hosts.

JONES (L. K.). **Streak and Mosaic of Cineraria.**—*Phytopathology* **34** no. 11 pp. 941–953, 4 figs., 9 refs. Lancaster, Pa., 1944.

An account is given of investigations in 1938–43 on two virus diseases, streak and mosaic, that are destructive to cinerarias in greenhouses in Washington. Both were transmitted through the seed and by mechanical inoculation, while streak was also transmitted by *Thrips tabaci*, Lind., and mosaic by *Anuraphis* (*Aphis*) *marutae*, Oestl. Both insects are common on cinerarias. Studies on host range indicated that the mosaic virus is specific to cineraria, but the streak virus was transmitted to tomato and pea, and the symptoms it produced in them, as well as its other characters, showed that it is a strain of the virus of tomato spotted wilt [*Lethum australiense* of Holmes].

BRIERLEY (P.) & SMITH (F. F.). **Some Virus Diseases of Alliums.** (Abstract.)—*Phytopathology* **34** no. 11 p. 990. Lancaster, Pa., 1944.

Onion yellow dwarf [*Marmor cepae* of Holmes] is transmissible to and from wild garlic (*Allium vineale*). Garlic mosaic from late or Italian garlic from Oregon is transmissible to onion and to *A. vineale* by sap and by *Myzus persicae*, Sulz. Symptoms differ from those of yellow dwarf in both these plants and the efficiency of transfer to onion is lower. Garlic mosaic in Spanish garlic was not transmitted to healthy Spanish garlic, *A. vineale* or onion by *M. persicae*.

A mosaic of the ornamental *A. neapolitanum* is transmissible to seedlings of this plant by *M. persicae*, but not to onion. Aster yellows [*Chlorogenus callistephi* var. *vulgaris* of Holmes] transferred from lettuce by *Macrosteles divisus*, Uhl., induced yellowing and dwarfing in 3 of 10 Ebenezer onions, reproducing symptoms occasionally seen in field grown onions replanted in greenhouses for seed production.

Lechevalier (H.). **Un nouvel ennemi pour les saules du Québec.**—*Nat. canad.* **71** no. 9–10 p. 210. Quebec, 1944.

The author took one adult of *Plagiodera versicolora*, Laich., in August 1942 and about a hundred in 1943 near La Trappe d'Oka, Quebec. This European Chrysomelid is established and injurious to willows and Lombardy poplar [*Populus nigra italica*] in the north-eastern United States [*cf. R.A.E.*, A **29** 438, etc.] but had not previously been recorded in Canada. In August 1942, however, it was also found at Belleville and Niagara Falls in Ontario.

Hocking (B.). **War against the Bostrychidae, " Bamboo Ghoon " and " Wood Ghoon " in Ordnance Stores.**—*Pest Control Pamphl. Ordn. Lab.* no. 1, [3+] 7 pp., 7 pls., 1 fig., multigraph. Cawnpore, 1942.

Much damage is caused in ordnance stores in India by species of *Dinoderus*, *Sinoxylon* and *Lyctus*, which usually infest bamboo, unconverted sapwood, and converted hardwoods, respectively. The adults of *Dinoderus* burrow into a bamboo and pair and oviposit inside it. The larvae mine along it and pupate in their tunnels, and the new adults usually bore out by the shortest route. The winter generation, hatching from eggs laid in October does not reach the adult stage till the following March. Adults of the first and second generations are active at about the end of June and the end of September. The life-cycle of *Sinoxylon* is much more variable and may last more than one year ; although there is an inactive period in November–March, there are no very definite peaks of activity. The adults tunnel radially through the bark into the sapwood, but turn before reaching the heartwood and bore partly round this ; the eggs are laid in the curved portion of the tunnel. The larvae bore predominantly along the wood ; pupation takes place at the end of the tunnel, and the adult bores directly to the surface. The adults of *Lyctus* do not bore into the wood, but lay eggs in the outer pores of the timber where it is cut or broken across the grain, and the larvae make burrows. The life-cycle of the more important species of *Lyctus* is similar to that of *Dinoderus*, but the three peaks of activity are less pronounced and occur in May, July and September. *Lyctus* is sometimes found with *Dinoderus* in bamboos and with *Sinoxylon* in wooden pegs, but does most damage to plywoods and packing-case wood.

Bamboos cut at certain times of the year, which vary for different parts of India, are much less liable to attack than those cut at other times, because they contain less starch. Timber transported by rail is attacked more than that transported by carts, probably because of the greater warmth. Rail consignments should be reduced during March–April, June–July and September–October, and all wagons cleared immediately they arrive during these months. Bamboos for tent poles should be rejected if borers are present unless a killing treatment can be given at once. It is more difficult to control borers in solid bamboos or wood, and uninfested material should be obtained, if possible, and given protective treatment immediately. Bamboos and wood should be stored together and preferably with other materials, to make it more difficult for the beetles to find food and oviposition sites. Stacks should be small and not tightly packed nor under cover. Bamboos should be inspected in March, June and late September and wood in April–May, June–July and September in the same way as when they were first received and by putting lights on pieces of

white material among the stacks at night and examining the insects attracted. Stock should be issued in the order it is received, and any accumulation of infested material should be separated from clean stores and burnt or treated as soon as possible. Any shed or yard that has held infested material should be thoroughly cleaned before being used again. Wood or bamboo is rendered immune from infestation by complete submergence in water for about three months if it is immersed shortly after cutting, or for two weeks longer if it has been allowed to dry. These times should be decreased if running water is used and increased if the wood is thicker than large tent-pegs. Insects already in it are killed by immersion for about ten days. Spraying with oil gives neither complete nor lasting protection ; dipping and swabbing with oil give complete temporary protection, particularly for wood, but do not affect insects that are already present. Soaking with oil is slow and expensive, but controls existing attack and gives complete and permanent protection if done thoroughly. Axial or radial drilling is essential and adequate draining time must be allowed for the recovery of superfluous oil. This treatment is most effective for wood and solid bamboos. Injection, preferably of a mixture of equal parts of mineral oil and creosote, is the best treatment for hollow bamboos, and the method of doing this is described. Maintaining the wood at a temperature of 145°F. and 90–100 per cent. humidity for 4½ hours kills all stages of *Lyctus* and probably of the other genera, but does not prevent reinfestation. Turning over the stacks of material to expose the beetles to birds, frogs, lizards and predacious insects is useful during the active periods.

The differences in susceptibility in wood and bamboos of various species is briefly discussed, but information on this subject is limited. Wood from leguminous trees or *Anogeissus latifolia* is particularly susceptible to *Sinoxylon*.

Hocking (B.). **Action against** *Anthrenus*. **'Woolly Bears' and what to do about them.**—*Pest Control Pamphl. Ordn. Lab.* no. 2, [2+] 4 pp., 4 pls., 1 ref., multigraph. Cawnpore, 1943.

Brushware in stores in India is damaged seriously by larvae of the Dermestid, *Anthrenus fasciatus*, Hbst., which also attack felt, furs, horsehair, leather, woollens, horn and almost any animal products. *Tinea pellionella*, L., infests similar material, particularly woollen clothing, but is less prevalent and more easily controlled. The female of *A. fasciatus* deposits 40–100 eggs in crevices in the vicinity of suitable food, and these hatch in about ten days. The larval stage may be completed in eight weeks or may last for several years, according to conditions of temperature, humidity and food-supply, and the pupal period is about a week. The adults are common in the open, where they feed on pollen, particularly of white flowers ; they are attracted to light. The material most commonly attacked by the larvae in India is pig bristle. Sterilisation against anthrax bacteria kills all stages, but sterilised bristle may be reinfested. Any bristle containing any stages of *Anthrenus*, as indicated by cast larval skins or loose hairs, should be rejected, and the premises of the supplier should be inspected and cleansed if necessary. To prevent attack, brushes or other susceptible material should be packed with naphthalene in cases that have no cracks and are as nearly airtight as possible. If not in sealed metal containers, the material should be inspected in May and October, when the naphthalene in each package should be made up to about 1 oz. per cu. ft., and torn lining paper and broken boards in the cases replaced. If infestation is discovered, all affected packages should be sorted in the open air. Unserviceable material should be burnt as soon as possible, and serviceable material subjected to a temperature of 140°F. for an hour at a humidity of 100 per cent., or dipped in boiling water for a few seconds or in hot water for a longer period, or thoroughly treated with cold water containing 1 lb. neutral soap per 10 gals., or fumigated. Exposure to the sun in hot weather usually kills the larvae but not the eggs or

adults. A measure that is still in the experimental stage consists in trapping the larvae in box traps with a bait of fish meal. Materials are rendered fairly immune from infestation by dyeing them with Martius yellow [2, 4-dinitro-α-naphthol], or, if they do not have to be washed, by soaking them in a 2 per cent. solution of sodium fluoride.

HARRISON (G. H.). **The Woolly Bear with special Reference to the Species *Anthrenus fasciatus* Herbst.**—15 pp., 4 pls., multigraph. [Cawnpore, Ordn. Lab., ? 1944.]

An account is given of the bionomics of *Anthrenus fasciatus*, Hbst., and of the morphology of the larva and adult, based on observations carried out in the Middle East and India, together with a discussion of the mating, oviposition and feeding habits of this and other species of the genus that have been recorded in different parts of the world as pests of stored products that contain keratin. *A. fasciatus*, which appears to be world-wide in distribution, is probably the most injurious species, but the degree of damage it causes is directly dependent on food-supply, temperature and the number of annual generations, which depends on cumulative temperature, though the effect of this is sometimes modified by humidity. Cold torpor sets in at 14°C. [57·2°F.] and results in a diapause of indefinite length that is terminated when conditions become favourable. Heat torpor, which soon terminates in death, begins at 40°C. [104°F.]. The life-cycle varies from four months (in India and the Middle East) to three years. In Cawnpore there were three generations and a partial fourth in the year. Optimum conditions for development appear to be a temperature of 32–35°C. [89·6–95°F.] and a relative humidity of about 70 per cent. The females laid 20–60 eggs in sheltered positions and these hatched in about 6–9 days. The larvae moulted 6–12 times and pupated in positions in which there was little external contact with solid bodies.

HOCKING (B.). **Anti-termite Tactics. How, when, and where to tackle White Ants.**—*Pest Control Pamphl. Ordn. Lab.* no. 3, [2+] 6 pp., 5 pls., 9 refs., multigraph. Cawnpore, 1943.

The author gives a short general account of the bionomics of subterranean termites, which are found all over India, and drywood termites, which occur in southern India and Ceylon, and detailed instructions on the prevention of damage by the former [*cf. R.A.E.*, A **30** 561]. Proposed sites for camps, depots and dumps should be inspected to determine whether damage from termites is likely. Conditions unfavourable to termites are high subsoil water, which eliminates certain species by driving the colonies too near to the surface of the ground ; soil free from woody vegetation and woody débris in the surface layers ; and very sandy soils, which dry out rapidly and make it difficult for the termites to maintain sufficient moisture in the highest parts of the colony. In infested areas, all stores should be insulated from the ground and arranged so that they can be inspected easily. A design for suitable supports, which keep the base of the stack at least 18 ins. from the ground and are surrounded by oil channels and capped with termite shields, is described and figured. Termites may be eradicated from an infested area by removing woody vegetation and the top 2–3 ins. of soil and then flooding it with water for some weeks ; where this is not practicable, nests may be dug out or blown up with gelignite. Infested buildings should be pulled down and rebuilt on termite-proof foundations [*cf.* **17** 730] if possible, but injecting creosote or blowing Paris green dust into the galleries is of some value. Cracks in cement floors should be chipped out to form a V-shaped channel, thoroughly cleaned and filled with a pitch or a good cement plaster. Methods of destroying termites by injecting fumigants or Paris green into the nests and of protecting wood from them by impregnating

it with preservatives are very briefly described. The ground below tent walls, ropes, poles and pegs should be treated with mineral oils or emulsions of them, or with the sludge that accumulates in tanks in which timber is treated with creosote or mixtures of creosote and oil.

BARNES (H. F.). **Two new Gall Midges from Mauritius.**—*Bull. ent. Res.* **35** pt. 3 pp. 211–213. London, 1944.

Descriptions are given of adults of both sexes of *Stenodiplosis stenotaphri*, sp. n., reared from the inflorescence of *Stenotaphrum dimidiatum*, a common pasture grass in Mauritius, and *Contarinia citri*, sp. n., from blossoms of *Citrus* spp. In October 1941, over 25 per cent. of the *Citrus* flowers at Beau Bassin were attacked, and many of those infested dropped prematurely. Adults emerged 10–12 days after young larvae had been collected, and the pupal stage lasted two days.

ROBERTSON (F. W.). **The Removal of Insect Pests from stored Products by Means of Behaviour Stimuli.**—*Bull. ent. Res.* **35** pt. 3 pp. 215–217. London, 1944.

When a stored product is infested by a fairly mobile insect pest, it is sometimes possible to remove the latter by making use of its reactions to external stimuli. The experiment described was carried out on tea to which adults of *Oryzaephilus* (*Silvanus*) *surinamensis*, L., had migrated from other products, and in which they did not breed. Preliminary tests showed that the beetles were stimulated to rapid movement by mechanical disturbance and avoided light and temperatures above 37°C. [98·6°F.], though they fell into heat rigours at about 50°C. [122°F.] when the temperature rose fairly rapidly. They were positively thigmotropic, which may explain their attraction to the tea, though there was also evidence that they reacted to its smell. They did not respond to gravitation or air currents. An apparatus was then devised, and is described, consisting of a conveyor belt illuminated by a row of electric lamps along one side only, and heated from below so that the temperature of the upper surface did not exceed 42–43°C. [107·6–109·4°F.]. The tea was fed on to the belt in a thin layer, leaving a margin on either side. Most of the beetles that left the tea fell into an oil bath below, and the remainder were collected from the darker margin by a suction pump. Not less than 90 per cent. of the beetles were removed from the tea. A formula is given for calculating the maximum rate at which such a belt should travel. If the belt is 20 ins. wide and the rollers are 15 ft. apart, the speed of travel is 0·66 ft. per second, and the tea can be treated at the rate of $8\frac{1}{2}$ cwt. per hour.

SIMMONDS (F. J.). **The Propagation of Insect Parasites on unnatural Hosts.**—*Bull. ent. Res.* **35** pt. 3 pp. 219–226, 37 refs. London, 1944.

The author reviews from the literature cases in which parasites of insect pests have been bred in the laboratory on hosts other than those that they attack in nature [*cf. R.A.E.*, A **26** 276; **30** 533; **32** 367], and discusses some of the results of this work in the laboratory at Belleville, Ontario, in 1941–43.

Of the parasites of *Cydia pomonella*, L., *Ascogaster quadridentata*, Wesm. (*carpocapsae*, Vier.) did not oviposit in eggs of *Ephestia kuehniella*, Zell., and *Cryptus sexannulatus*, Grav., *Ephialtes caudatus*, Ratz., and *Aenoplex carpocapsae*, Cushm., did not oviposit in cocoons of this moth. Normal progeny of the last three parasites was obtained, however, when eggs laid on hibernating larvae of *Cydia* in their cocoons were transferred to larvae of *Ephestia* that had been killed by coddling for one minute at 100°F. Females of *Chelonus texanus*,

Cress., which was bred from *Loxostege sticticalis*, L., from Montana, readily oviposited in eggs of *Ephestia kuehniella* and the larvae developed normally in those of this host. Four generations were reared on it, and 300,000 parasitised hosts were shipped to South Africa. *Meteorus loxostegei*, Vier., which parasitises young larvae of *L. sticticalis*, readily oviposited in larvae of *E. kuehniella* and hibernating larvae of *Cydia pomonella*, but though the parasite larvae hatched, practically all of them died, only one adult being obtained from 50 parasitised examples of each species. An attempt to breed *Spalangia drosophilae*, Ashm., an American parasite of the puparia of *Oscinella frit*, L., on puparia of *Musca domestica*, L., was not promising, as the rate of mortality was very high, but *Drosophila melanogaster*, Mg., which has a less thickly chitinised puparium, proved a very good host. *Loxotropa* sp., which also parasitises *O. frit*, oviposited in puparia of *Drosophila*, but few adults were obtained, while *Hexacola* and *Polyscelis*, which parasitise the larvae of *O. frit*, failed to oviposit in larvae of *Drosophila*.

In experiments on rearing parasites on artificial media, the possibilities of which are discussed, eggs of *Ephialtes caudatus* and *Cryptus sexannulatus* hatched when placed on nutritive gelatine slopes or raw beef, but only one larva moulted, on beef, and no adult was obtained.

It is concluded from a review of the literature and the laboratory work that there is little risk of segregating strains of parasites that will not attack their natural hosts after being bred on others.

Rivnay (E.). **Physiological and ecological Studies on the Species of *Capnodis* in Palestine (Col., Buprestidae). I. Studies on the Eggs.**—*Bull. ent. Res.* **35** pt. 3 pp. 235–242, 4 graphs. London, 1944.

There are six species of *Capnodis* in Palestine, all of which attack the roots of their food-plants. *C. tenebricosa*, Ol., and *C. miliaris*, Klug, which infest *Rumex* and poplar, respectively, are of no economic importance; *C. cariosa*, Pall., which attacks *Pistacia* spp. and *Schinus molle*, and *C. porosa*, Klug, which attacks *Prunus* spp., including almonds in the hills of Judaea and Samaria, are of slight importance; and *C. tenebrionis*, L., and *C. carbonaria*, Klug, which attack all stone-fruit trees, are major pests. *C. tenebrionis* occurs in the mountain regions and the inland valleys, and *C. carbonaria* is abundant throughout the country.

Notes are given on the appearance and size of the eggs of *C. tenebrionis*, *C. carbonaria*, *C. miliaris* and *C. cariosa*, together with the results of a chemical analysis of the shell of those of *C. tenebrionis*. In tests at 27°C. [80·6°F.] on the effect of relative humidity on eggs of this Buprestid, the mortality percentages were 53 and 100 at 87 and over 95 per cent., 22–24 at 52, 33 and less than 10 per cent., and only 8 and 7 at 66 and 75 per cent. All eggs that hatched did so in 12 days. The egg shell is hygroscopic, which renders the egg resistant to complete dryness for over 10 days. When the eggs were exposed for 1–7 days to over 95 per cent. humidity before being kept at 70 per cent., the percentage mortality increased fairly regularly with exposure from 30 to about 90; this is in agreement with the observation that *Capnodis* is of less importance in irrigated areas.

The duration of the egg stage is much the same for *C. tenebrionis*, *C. carbonaria* and *C. cariosa*. The optimum temperature is about 30°C. [86°F.], at which it lasts 10 days, for although eggs of *C. tenebrionis* hatched in a week at 35–37°C. [95–98·6°F.] the mortality was high,. At average temperatures of about 29°C. [84·2°F.] in July and August and 26°C. [78·8°F.] in September and October, the egg stage lasted 11 and 16 days, respectively, for *C. carbonaria*, from which the threshold of development was calculated to be 19·4°C. [66·92°F.] and this was confirmed in laboratory breeding. When eggs of *C. tenebrionis* were kept

for various periods at 13 or 6–7°C. [55·4 or 42·8–44·6°F.] before being transferred to 27°C., the percentage mortality rose to 82 for 16 days at 13°C. and 92 for 10 days at 6–7°C., while exposure for up to 8 hours to 40 and 46°C. [104 and 114·8°F.] before being kept at 27°C. had little effect on mortality, and even similar exposure to 50°C. [122°F.] killed less than two-thirds, though exposure to 45°C. [113°F.] for two days results in complete mortality.

Birch (L. C.) & Andrewartha (H. G.). **The Influence of Drought on the Survival of Eggs of *Austroicetes cruciata*, Sauss. (Orthoptera) in South Australia.**—*Bull. ent. Res.* **35** pt. 3 pp. 243–250, 3 figs., 8 refs. London, 1944.

In the grasshopper belt of South Australia the eggs of *Austroicetes cruciata*, Sauss., remain in diapause throughout the summer [*cf. R.A.E.*, A **30** 511, etc.]. In a laboratory experiment in February, exposure of parcels of eggs to 50°C. [122°F.] for 24 hours and to 60°C. [140°F.] for one hour resulted in mortalities of 45 and 88 per cent., respectively, but a field survey made in April 1939 after an exceptionally dry hot summer in which one-inch soil temperatures in January probably reached 60°C. showed that the average percentages of eggs dead were 91 at Hawker, 64 at Hammond and 36, 31 and 22 at the three other places examined. The mortality was highest in the places in which the summer had been driest, and was reduced in situations in which the eggs were most easily moistened by light rain. It is concluded that high temperatures can have little direct influence on mortality, which is caused mainly by drought, to which eggs may be exposed at various stages of their development.

Water is lost more rapidly from eggs in which the diapause has been eliminated [*cf.* **30** 510] so that eggs in the field become less resistant to desiccation from June to September. However, the saturation deficit of air in the soil at that season is low, and the probability of high mortality due to drought is negligible. In the hatching season, from 15th August to 20th September, emergence of nymphs, which usually occurs after showers of rain, may be prevented during a dry spell by the caking of the soil. In the laboratory, newly emerged nymphs survived without food for an average of six days at 20°C. [68°F.] and 75 per cent. relative humidity, at which the saturation deficit is higher than that likely to occur in the field. Analysis of records of temperature and rainfall from six representative stations for the 50 hatching seasons from 1891 to 1940 and their comparison with estimated dates of hatchings [**32** 244] showed that six-day droughts with less than 0·02 inches of rain may be expected to coincide with the peaks of hatching 12 times in a thousand years, so that high mortality from drought at this season is again improbable.

It is during the summer that eggs are exposed to the most severe hazards. The high temperatures that prevail affect the relative humidity of the air in the soil spaces. In soils sampled to a depth of one inch at two stations at Hammond on 3rd January 1939 this was found to be 21 and 11 per cent., respectively, which would result in the eggs being exposed to a saturation deficit of about 0·7 inches of mercury. As shown in an earlier paper [**30** 510], mortality of eggs in diapause from exposure to high saturation deficit depends on the amount of evaporation and duration of exposure. In this connection, small falls of rain become important ; experiments made to evaluate their influence showed that 0·2 and 0·25 inches were required to moisten sandy and loam soils, respectively, to the depth of an egg-pod. On the basis of these findings, meteorological records for the same 50 years but for the period from November to April were analysed, daily rainfall and estimated mean daily evaporation [*cf.* **28** 593] being used to estimate the duration in which moisture content was below the wilting point. During the 50 years, evaporation in the longest dry spell exceeded 26·2 inches (which at Hammond in 1938–39 resulted in 64 per cent.

mortality) on 5 to 16 occasions depending on the district. Evaporation of 40·6 inches (which at Hawker in 1938–39 killed 91 per cent. of eggs) was exceeded from one to seven times.

ROBERTSON (P. L.). **A Technique for biological Studies of Cheese Mites.**—*Bull. ent. Res.* **35** pt. 3 pp. 251–255, 5 figs., 4 refs. London, 1944.

Descriptions are given of the apparatus and technique used for studying the development, under conditions of controlled temperature and humidity, of *Tyrophagus putrescentiae*, Schr. (*longior*, Gerv.), *Tyrolichus casei*, Oudm., and *Tyroglyphus farinae*, Deg., which are the mites that infest cheese in New Zealand. The cells used for oviposition were made in small fibre strips $\frac{1}{8}$ in. thick. Towards one end, a round hole with sloping sides and with an upper diameter of 1·5–2·5 cm. was cut through the fibre, and black filter paper was pasted over the bottom, providing a permeable base to the cell. The junction of the wall and the filter paper was sealed with gelatine size. The cover was a glass slide held in position by a smear of paraffin and vaseline. For oviposition, 40 adult mites were introduced into each cell through a small hole in the cover, which was then sealed with cellophane, and the cells were placed on special holders, each accommodating two, which were suspended in humidity jars. The eggs were laid on the under surface of the cover slips. The humidity was controlled by means of solutions of sulphuric acid, the vapours from which did not affect the development of the mites. The larvae and nymphs were reared in similar, slightly larger cells, with dried milk as the food. For purposes of measurement, the mites were immobilised by storage for 2–3 hours at a temperature between −1 and 2°C. [30·2–35·6°F.] and then each cell was placed on a brass plate fitting over a small insulated ice-box that could be inserted between the stage arms of a binocular microscope.

ARTHUR (D. R.). *Aphidius granarius*, **Marsh., in Relation to its Control of** *Myzus kaltenbachi*, **Schout.**—*Bull. ent. Res.* **35** pt. 3 pp. 257–270, 8 figs., 11 refs. London, 1944.

An account is given of observations on the bionomics of *Aphidius granarius*, Marsh., which parasitises the Aphid, *Myzus kaltenbachi*, Schout., on cereals in South Wales, together with descriptions of the immature stages of this Braconid and the internal anatomy of the mature larva. In the laboratory at 67°F., most of the adults paired within three days of emergence, and the females oviposited 5–87 minutes later. The number of eggs deposited per female ranged from 153 to 382, and most were inserted into the abdomen of the host. Several were sometimes laid in a single Aphid, but only one adult parasite emerged in such cases. The egg and larval stages lasted 4–6 days and about a fortnight, respectively, at 67°F., and the prepupal stage 4–7 days at 60°F. and 4–5 days at 70°F. Pupation occurred within the host, which became moribund 13–34 days after oviposition by the Braconid. Aphids parasitised in the first two instars did not reach maturity, those parasitised in the third instar became adult but did not reproduce, and those attacked later produced comparatively few young. Very few alates were parasitised in the field or laboratory.

The ratio of males to females was 10 : 12·9 ; unfertilised females gave rise to males only. When given an abundance of Aphids, adults survived for 17–25 days at 45°F. and 7–40 days at room temperature. Unfed adults rarely lived for more than a week, but survival was increased by 3–15 days by feeding on weak carbohydrate solutions. Adults given the carbohydrate secretions of Aphids lived for 21–27 days.

There are several generations a year, and winter is passed by the full-fed larva in the cocoon, the first adults emerging about mid-March, shortly after the appearance of the Aphids. Random collections from oat fields showed that the

percentage parasitism did not reach 50 until about mid-May, while at the end of May and in early June it ranged from 76 to 95. This high level was maintained until the end of July, when there were very few unparasitised Aphids, though this may have been due to migration. In laboratory tests on the apparently high rate of reproduction indicated by field observations, 23 fertilised females each confined with 20 adult apterae gave rise to a total of 1,886 adult progeny (39–89 per individual) and 10 unfertilised ones to 624 (25–73). Both lots of offspring completed their development in 18–23 days. The rates of parasitism after 38 days among the Aphids and their progeny in typical cases in each series were 92·9 and 86·5 per cent., respectively.

MACFIE (J. W. S.). **Ceratopogonidae collected in Trinidad from Cacao Flowers.**—*Bull. ent. Res.* **35** pt. 3 pp. 297–300, 1 fig. London, 1944.

Ceratopogonids recently collected on cacao in Trinidad were found to comprise *Forcipomyia quasi-ingrami*, Macfie, *Lasiohelea nana*, Macfie, and *L. stylifer*, Lutz, from the flowers, and *Atrichopogon brevipalpis*, sp. n., *Dasyhelea* sp. and *Stilobezzia* sp. from moss on the trunks. Descriptions are given of all of them except *L. stylifer* and *Dasyhelea* sp., each of which was represented by a single damaged female. *F. quasi-ingrami* and *L. nana* are believed to be of importance in the pollination of cacao.

WHITEHEAD (F. E.). **The Effect of various Diluents on the Toxicity of Derris Dust to House Flies** (*Musca domestica* **L.**).—*Proc. Okla. Acad. Sci.* **24** pp. 27–28. Guthrie, Okla., 1944.

Experiments in which the test insect was *Musca domestica*, L., were carried out to determine whether the insecticidal action of derris dust could be increased by using a diluent other than talc, which is the one commonly employed. Three parts by weight of the diluents were thoroughly mixed with 1 part derris (5 per cent. rotenone), and the flies were exposed for 30 seconds to a current of air carrying a weighed amount of the mixture and then transferred to an undusted cage. The diluents and (in brackets) the percentage mortality when each was used were : precipitated sulphur (93·5), cupric sulphide (90·9), dusting sulphur (89·5), powdered sodium chloride (85·4), barium carbonate (71·0), tannic acid (69·8), zinc oxide (69·4), talc (41·0), acetanilide (40·3), paraformaldehyde (33·3), calcium carbonate (22·8), zinc carbonate (17·6), calcium hydroxide (15·6), magnesium oxide (14·9), kaolin (11·6) and manganese dioxide (11·5). It is pointed out that these mixtures might not show the same differences in relative toxicity to insects of other species, and that some of the diluents would not be safe to use on plants ; sulphur scorches cantaloupe melons severely. The tests strongly indicate, however, that a diluent for derris more effective than talc may be found for use against insects commonly controlled by derris dust.

RICE (P. L.). **Two Apple Pests new to Delaware Growers.**—*Trans. Peninsula hort. Soc. 1943* pp. 37–41, 2 figs., 4 refs. Dover, Del., 1944.

Coleophora malivorella, Ril., has been injurious to apple in some parts of Delaware since 1940 [*cf. R.A.E.*, A **30** 37] ; notes, based largely on a paper already noticed [**30** 287], are given on its bionomics and control.

Pseudococcus comstocki, Kuw., has been present in one apple orchard in the State since 1941, and caused considerable injury to the fruit during 1942 and 1943 ; it is known to occur in three other orchards, but is of economic importance in only one of these. There are three generations in the year and the winter is passed in the egg stage under loose pieces of bark on the trunk, under leaves in the crotches and in other protected positions on the tree. The eggs of the

overwintering generation hatch from about the beginning of May and the nymphs congregate at points on the twig, branches and leaves. Eggs of the first generation are deposited largely on the trunk and lower branches and begin to hatch at about the beginning of July. The mealybugs of this generation feed on the bark and the fruit ; they mature and oviposit in August, and oviposition by females of the second generation occurs during October and November. Nymphs of the first and second generations cause most injury, by feeding on the fruit ; a sooty mould develops on the honeydew they excrete. The overwintering eggs may be destroyed by scraping rough bark from the trunks and larger branches and removing leaves resting in crotches and burning them, but the most promising method of control is by means of an introduced parasite of the genus *Pseudaphycus* [*cf.* **31** 468, 486]. This was colonised on trees in the first orchard in August 1943, and nearly two-thirds of the adult mealybugs collected from these trees in October were parasitised.

Huffaker (C. B.), Wolfenbarger (D. O.), Chada (H. L.) & Rice (P. L.). **Mexican Bean Beetle Studies in Delaware 1943.**—*Trans. Peninsula hort. Soc. 1943* pp. 114–118, 2 figs., 3 refs. Dover, Del., 1944.

Periodical examination of 32 fields of lima and snap beans planted between early May and early July in central and southern Delaware in 1943 indicated that infestation by the Mexican bean beetle [*Epilachna varivestis*, Muls.] and leaf injury were greatest in fields planted in early May and least in those planted in early June, and that yields increased as infestation decreased. Beans planted in late May and early June apparently developed too late to be injured by the first generation and were nearly mature before the second generation appeared.

In insecticide tests in which fields of lima beans planted 10th July were treated on 7th August, when 25 per cent. of the leaves were injured by the beetles, a dust containing 0·75 per cent. rotenone, applied at 42 lb. per acre and one of synthetic cryolite and talc (1 : 1), at 36 lb. per acre, increased the yield significantly ; a dust containing 0·5 per cent. rotenone, which is usually effective, increased the yield, but the difference was not significant, probably because the application was late and hot dry weather prevented the development of dense populations of beetles. Foliage injury averaged more than twice as much on undusted as on dusted plots. It was found that small numbers of beetles caused proportionately more foliage injury than large ones ; since 20 per cent. of the total leaf surface was injured when there were as few as ten individuals (larvae, pupae and adults) per five feet of row, it appears that early applications of insecticides are needed to prevent serious damage by small numbers of adults and larvae. Leaves of bush lima beans treated when in an advanced stage of growth with one, two or three weekly applications of cryolite dust (40·7 per cent. fluorine) at the rate of 24·2 lb. per acre per application showed 85, 115 and 85 parts fluorine per million (dry weight) at harvest, as compared with 26 p.p.m. for untreated plants, and the vines had 52, 65, and 45 p.p.m. as compared with 14 p.p.m. for untreated plants. The first, second and third applications were followed by 0·27, 0·81 and 1·91 ins. rain, respectively. Significantly more fluorine was found in treated samples than in untreated ones and on the leaves than on the vines, but there was no significant difference in the residue from one, two and three applications.

Rice (P. L.). **Final Report on the Program for the Colonization of the causative Agents of the Milky Disease of Japanese Beetle Larvae in Delaware.**—*Trans. Peninsula hort. Soc. 1943* pp. 121–124, 1 fig., 2 refs. Dover, Del., 1944.

In this report on the establishment of milky disease [type A, caused by *Bacillus popilliae*] among larvae of the Japanese beetle [*Popillia japonica*,

Newm.] in Delaware [*cf. R.A.E.*, A **31** 365, etc.], the progress made during 1943 is reported and the results of the three-year campaign are summarised. Nearly all suitable rural areas in New Castle and Sussex Counties were treated at two half-acre inoculation points per sq. mile and those in Kent County at four per sq. mile in 1941 and 1942. During 1943, two additional inoculation points per sq. mile were established in parts of the first two counties, and the sod areas in several towns that had not been treated were given heavy spore-dust inoculations. Surveys showed that larvae had become infected at many of the points of inoculation and that the disease was spreading, and it is concluded that although *P. japonica* will probably continue to be of importance for several years, at least on its favourite food-plants, its destructiveness should be substantially reduced.

HAMNER (A. L.). **The Effect of Boll Weevil Infestations at different Levels on Cotton Yield.**—*Bull. Miss. agric. Exp. Sta.* no. 389, 11 pp., 4 figs., 6 refs. State College, Miss., 1943.

In order to determine the most economic use of control measures against *Anthonomus grandis*, Boh., on cotton, the effect of the loss of squares on the fruiting habits of the plant and the amount of damage to be expected from different degrees of infestation were investigated in Mississippi in 1939–42. Observations on yield were made on plots in which infestation was kept as low as possible and squares were removed at weekly intervals throughout the fruiting period (eight weeks) [*cf. R.A.E.*, A **30** 547 ; **32** 275]. It was found that the percentages of flowers that gave rise to mature bolls were always higher on the treated plants than on the controls, even when the percentage of squares removed each week were as low as 10, and that the total number of flowers produced each year on treated plants decreased as the percentage of squares removed was increased. The bolls produced by treated plants were heavier than those produced by the controls, and the number per lb. seed cotton was reduced by nine or more on plots from which all squares were removed after the seventh week of square production. In 1939, the highest average yield was obtained from plots in which the percentages of squares removed in successive weeks were 10, 20, 30, 40, 50, 50, 50, and 50 ; the highest loss in yield from this treatment in any of the three years was 5·5 per cent. The yields from plots in which the percentages of squares removed were 10, 20 and 30 in the first three weeks and 40 in the other weeks were higher than from the controls in two years and only 0·9 per cent. lower in the third. It is therefore concluded that the protection of squares from damage by *A. grandis* confers very little gain under many conditions of infestation that occur in Mississippi.

In investigations on the effect of infestation by *A. grandis* on losses, the percentage of punctured squares was recorded and a number of flowers were marked on the same day. The average percentage of locks lost by the bolls that subsequently developed from these flowers was found to be 1·05 for each percentage of squares punctured in 1939 and 1·1 in 1942. An increase in the percentage of punctured squares from 10 on 25th August to over 80 on 8th September in 1940 resulted in more than 90 per cent. loss of lock in bolls set on cotton, the fruiting of which was delayed by a flood. Experiments in one year indicated that calcium-arsenate dust reduced the percentage of locks lost in bolls set during the 10–12 days previous to that on which the dust was applied. Four varieties of cotton set approximately 8 per cent. of their crop during the first week of fruiting, and over 70 per cent. during the next four weeks. It is estimated that no appreciable gain follows the control of *A. grandis* unless the plants produce an average of at least one flower per 5 ft. of row, and that control measures are justifiable only where at least 25 per cent. of the squares are punctured during the first and last weeks of square production.

Michelbacher (A. E.) & Smith (R. F.). **Some natural Factors limiting the Abundance of the Alfalfa Butterfly.**—*Hilgardia* **15** no. 4 pp. 369–397, 13 figs., 14 refs. Berkeley, Calif., 1943.

An account is given of the methods and results of investigations in 1939–42 on the development and natural control of *Colias chrysotheme*, Esp., on lucerne in California. The authors use the name *C. eurytheme*, Boisd., for this Pierid, of which they describe all stages, but point out that Clark (1941) has shown *eurytheme* to be merely a form of the European and Asiatic *chrysotheme*, Esp. The work was carried out in a region adjacent to San Francisco Bay, where it is not of economic importance, probably because the cool coastal climate retards development, and in the north-western part of the San Joaquin Valley, where it is sometimes very destructive, though the damage varies from year to year and from field to field. Infestation there was light in 1939, moderate in 1940 and unusually severe in 1941.

The larvae were found in small numbers at practically all times during the winter, but it is probable that the coldest period, particularly in cold winters, is passed in the pupal stage [*cf. R.A.E.*, A **29** 600]. The adults were not common in the San Joaquin Valley area until April, and the first increase in numbers of larvae occurred in early June, probably owing to the hatching of the first generation. The life-cycle appeared to be completed in 30 days in the field, and increasingly injurious generations occurred in July and in late August and early September; still later there was a further smaller one. The occurrence of larvae in winter was similar in the San Francisco Bay area, but there was no marked increase in summer.

The most important agent in natural control was *Apanteles flaviconchae*, Ril., and the wide fluctuations observed in populations of *Colias* are attributed largely to its influence. Its development was completed in 11–13 days at 80°F., whereas that of *Colias* required three weeks at this temperature. It oviposited only in larvae of the first three instars, and the parasite larva left the host when the latter was in the third or fourth instar. The parasite cocoons occur singly on the leaves. Though only one parasite develops in a single host, several eggs may be laid in a single larva, which may die in consequence. *A. flaviconchae* was taken in every month except January, and probably overwinters as an adult or in the cocoon. Percentage parasitism varied considerably from year to year in early summer, but was almost 100 by late summer, and remained at this level into December. The size of later generations of *Colias* can be estimated from the percentage parasitism and numbers of large larvae present in June; when parasitism among the small first-generation larvae exceeded 35 per cent., a high infestation developed in only one field, in which there was an unusually high percentage of large larvae. Parasitism tended to be low when the host population was low, and the number of adults of *Colias* present provided little indication of the amount of damage to be expected.

When *Apanteles* failed to control the later broods of *Colias*, a wilt disease was often of importance. It is not known whether it is identical with the disease attributed by Brown to *Staphylococcus flaccidifex* [**18** 396]; experiments by the junior author and M. Douderoff indicated that a bacterium present in dead and dying larvae is not the primary causal agent. The disease was apparently restricted to the mid-summer and late summer generations and was frequently not beneficial until the crop was seriously damaged. Under favourable conditions, however, it destroyed the larvae very quickly; on one occasion it reduced a heavy infestation by over 99·9 per cent. in the week beginning on 29th July. High host populations and humidity are required for it to reach epidemic proportions, and timely irrigation may render conditions favourable for it; even where it did not become epidemic it sometimes exerted commercial control. Epidemics appeared to have an adverse effect upon *Apanteles*, possibly because parasitised larvae were destroyed before the parasites could leave

them ; percentage parasitism among small larvae in September 1941 was 16 in a field in which the disease was prevalent and 82 in the surrounding area. Nevertheless, the parasite was sometimes effective after the disease had reduced the host populations. Where the disease was not abundant, *Apanteles* was not greatly affected ; the two agents apparently act independently, the parasite reducing the small and the disease the large larvae. Under these conditions there is little risk of the parasite transmitting the disease by means of its ovipositor, if this is possible.

In a discussion of the application of these results to control, it is suggested that cutting dates should be so arranged that the lucerne is growing while larvae of *Colias* are scarce, and only stubble is present when their numbers are increasing. The crop should be grown quickly and cut as soon as mature in order to allow as little time as possible for the building up of the first generation. Insecticides [*cf.* **32** 194] should not be applied unless it is certain that *Apanteles* is not able to exert control, and contact insecticides, most of which are likely to kill adults of the parasite, should not be used unless it is known that they will afford effective control. The exact cause of heavy mortality following the use of an insecticide should be determined as it may be due to the wilt disease.

A survey in 1942 showed that *A. flaviconchae* was present in 22 counties of California and that the wilt disease also occurred in most of them. It is believed that the conclusions regarding the operation of these factors in the region studied are applicable to the rest of the State.

WALKER jr. (F. H.). **Life Histories and Control Tests on three Insect Pests of Skins stored in the Tannery.**—*J. Kans. ent. Soc.* **17** no. 1 pp. 7–14, 11 refs. Manhattan, Kans., 1944.

Sheep skins of the type known as shearlings stored in a tannery in Massachusetts were infested with *Dermestes maculatus*, Deg. (*vulpinus*, F.), *Tineola biselliella*, Humm., and *Necrobia rufipes*, Deg. ; the first was abundant and injurious for several years, the second was sufficiently numerous to cause damage in one year, and the third occurred each year in such small numbers that it caused little damage. The skins were of domestic origin, dried and salted on the premises, tied in loose bundles and stored in large piles, in the first year of the investigation, and dry salted foreign ones in tightly packed bales in later years.

D. maculatus is found throughout the United States and shows a marked preference for skins of all kinds, but is also troublesome in establishments dealing in dried animal, dried fish, and raw fertiliser materials. The adults are strong active fliers and feed on a variety of flowers and shrubs ; they may be found in some heated buildings at any time of year, but are usually more abundant during spring and summer. In the tannery, they made long shallow furrows on the flesh side of the skins ; the larvae, which are more injurious, cut channels on the same side and often penetrated to the grain, though they did not feed on the grain or in the wool. The younger larvae were found in colonies in the thick greasy parts of the skins where the eggs had probably been deposited. Both larvae and adults were most abundant just inside the piles of skins away from the light ; they were never found in the centre of bundles or bales. Pupae were often found in the wool and in the larval burrows, and adults burrowed in the wool, but apparently did not injure it. The adults live for 60–90 days, and the egg, larval and pupal stages usually last 3–10 days, about 6 weeks and 10–11 days, respectively, but the larval stage has been known to last 1–3 years in adverse conditions. Adults and larvae confined together on a piece of chamois leather caused only slight damage to it and died in two weeks, and adults fed little on suede and not at all on damp cowhide or wet shearling, though they thrived on dried cowhide.

Both larvae and adults died soon after thorough spraying with orthodichlorbenzene. In fumigation tests, crystals of paradichlorbenzene took much longer to evaporate than the liquid orthodichlorbenzene, which gave complete control when it was poured at the rate of 2 lb. per 10 cu. ft. over isolated piles of skins, which were then thoroughly covered with paper. Orthodichlorbenzene was also more effective than a mixture of ethylene dichloride and carbon tetrachloride. In the method of control finally adopted, it was used as a fumigant at the rate of 3 lb. per cu. ft. skins, which killed some of the insects and drove the others to the surface of the bundles or bales, and as a contact spray to kill the latter. The bundles of skins were arranged in small piles with the fumigant added to them, and the bales were spaced in rows to allow for its penetration and facilitate access for spraying. All openings in the area fumigated were closed to confine the fumigant and prevent the spread of the insects. Light-traps and baits did not prove effective. General recommendations for the protection of the skins comprise cleaning the store before they are brought in, keeping windows screened and doors closed, and arranging bundles of skins in small piles 6–8 ft. high and 3–4 ft. wide and bales in rows. If infestation occurs, skins that are attacked should be removed and used at once, and fumigation should be carried out.

The skins became infested with *T. biselliella* before they were stored. The larvae were found in the wool, but did not damage the skin itself. The adults began to appear in late July, and emergence continued until late autumn; they were destroyed by applying a light spray of orthodichlorbenzene well into the bales to drive them out, and making a second application soon afterwards to kill them on the surface or in flight.

The habits of *Necrobia rufipes* are briefly reviewed [*cf. R.A.E.*, A **13** 508; **27** 584]; it is considered to be sometimes predacious, but was not observed to attack the larvae of *D. maculatus*. The adults caused considerable damage to the flesh side of skins in captivity.

TOOKE (F. G. C.). **Progress of Forest Entomology in South Africa.**—*J. S. Afr. For. Ass.* no. 10 pp. 4–12, 4 pls. Johannesburg, 1943.

Notes are given on the history, incidence, bionomics and control of insects that attack introduced forest trees in South Africa. The more important are *Gonipterus scutellatus*, Gylh. [*R.A.E.*, A **32** 355] and *Phoracantha semipunctata*, F. [**17** 245], which feed on *Eucalyptus*, and *Nudaurelia cytherea capensis*, Cram. [**31** 267], *Euproctis terminalis*, Wlk. [**28** 403] and *Heliothrips haemorrhoidalis*, Bch. [**24** 336], which attack pines (*Pinus* spp.). Pests of minor importance are *Gonimbrasia tyrrhea*, Cram. [**24** 336], which attacks pines and *Acacia* spp. and is controlled by the methods employed against *N. c. capensis*; *Pachypasa capensis*, L. [**13** 613] the larvae of which are present throughout the winter months, occasionally defoliate *Acacia mollissima* in the eastern Transvaal, and also feed on pines, notably *Pinus patula*, to some extent, but are generally reduced by parasites and disease after two or three years; *Pachypasa albofasciata*, Auriv., a heavy and extensive outbreak of which was reported on *Pinus radiata* (*insignis*) for the first time in 1942; *Nadiasa* (*Taragama*) *concolor*, Wlk., which also occurs on *P. radiata*, but is controlled by natural agents [**24** 335]; *Teragra guttifera*, Hmps., which attacks poplar (*Populus deltoides*) in parts of the Cape Province and to a less degree in Natal, and can be controlled by the destruction of infested trees and the application of tar to pruning wounds and the entrances to larval tunnels [**29** 18]; *Metarbela sticticosta*, Hmps., which has caused severe damage to oaks in the eastern Transvaal, where, however, these trees are not of commercial importance; *Prasoidea* (*Odontionopa*) *sericea*, Gylh., which often kills a high proportion of transplants of *Pinus radiata* in the western Cape Province [**13** 613]; *Colasposoma acaciae*, Bryant; and *Hylastes opacus*, Erichson. The larvae of *C. acaciae* feed on rootlets and humus in the

soil, but the adults periodically injure wattle (*Acacia*) regeneration in part of eastern Transvaal. Outbreaks of this Eumolpid appear to be correlated with heavy rains in early spring, as a high moisture content is necessary for successful pupation. The adults can be controlled by means of pyrethrum or arsenical dusts. *H. opacus* caused considerable injury to newly-planted conifers in two districts in 1942, although it did not damage young trees when it was first reported in Cape Province [**19** 24]. There are two generations of this Scolytid each year, and poor soil conditions, frost damage and bad planting predispose the trees to attack. Billet traps of pine 2–3 ft. long and 2–3 ins. in diameter kept in contact with the ground from October to December and from January to June are recommended against the ovipositing females ; others may be in use throughout the season to trap the feeding adults. Measures against beetles that attack freshly-felled, sawn and seasoned timber are briefly reviewed.

Damage to Sapwood of Hardwoods by Powder-post Beetles.—*Rhod. agric. J.* **41** no. 2 pp. 73–78, 2 figs., 6 refs. ; also *Bull. Minist. Agric.* [*S. Rhod.*] no. 1259, 7 pp., 2 figs., 6 refs. Salisbury, S. Rhod., 1944.

Short accounts are given of the bionomics of powder-post beetles (Lyctids and Bostrychids) [*cf. R.A.E.*, A **16** 185], which attack the sapwood of recently seasoned and partly seasoned hardwood timber, and measures against them, based on investigations in various countries, are described [*cf.* **16** 139 ; **29** 448, 466, etc.]. They are becoming of importance in Southern Rhodesia, as war conditions have resulted in the increased use of hardwoods for timber. Timber there should be inspected several times a year, particularly during September–April, and infested wood should be treated or destroyed immediately. Susceptible timber should be dipped in a preservative solution or brushed with it before being stacked for seasoning. Timber to be used in positions exposed to the weather may be treated with a mixture of creosote and crude oil (80 : 20), and that for interior work with aqueous solutions of various chemicals, such as zinc chloride, zinc sulphate, arsenicals, sodium fluoride, borax or boric acid. These should be applied under pressure if possible, but give satisfactory results when properly used in an open tank. The wood should be dried until it has a moisture content of not more than 25 per cent. and immersed in the preservative, and the latter should be heated to 180°F. and kept at this temperature long enough to heat the wood thoroughly (usually three hours). The wood should then be left to cool in the preservative for 24 hours or be transferred quickly to a tank containing cold preservative and left there for several hours. The same materials give some protection if brushed or sprayed on the wood several times in hot solutions, but the penetration is inadequate, and this method is recommended only as a preliminary treatment for unseasoned wood. Brushing on as much of a solution of 5 per cent. pentachlorphenol in a medium solvent naphtha as the timber will absorb gives considerable protection from attack, and a mixture of equal parts of heavy solvent naphtha and diesel gas oil is also useful. Solvent naphtha alone kills insects in the wood, but does not prevent reinfestation. A mixture of equal quantities of turpentine and kerosene or a solution of 5 per cent. paradichlorbenzene in kerosene mixed with an equal volume of pure spirits of turpentine may be injected into flight holes in articles of value ; the treatment should be repeated every two or three days until powder no longer exudes, and the wood should be kept under observation for some time so that further outbreaks can be dealt with immediately. It is suggested that timber should be kept in logs as long as practicable, so that the moisture content will be too high for attack while the starch in the timber is being depleted.

Damage is sometimes caused by pinhole borers (ambrosia beetles), which attack both the heartwood and sapwood of green timber, but not seasoned timber. The best method of reducing liability to attack is to fell in the dry season and remove the timber from the forest as soon as possible and before

the time of maximum activity of the beetles, which occurs from August or September until just after the end of the rains. Logs should be sawn immediately after felling and the sawn timber stacked so that it dries as quickly as possible.

[Harris (W. V.).] **Annual Report of the Entomologist for the Year 1943.**—5 pp. typescript. [Morogoro] Dep. Agric. Tanganyika, 1944.

Nomadacris septemfasciata, Serv., had been controlled before the end of February in the outbreak centre in Tanganyika Territory [in which eggs had been laid in December 1942 (*cf. R.A.E.*, A **31** 359)]. Further swarms were observed in June, August, September and December, but no oviposition is reported. Swarms of *Schistocerca gregaria*, Forsk., were observed in February, March and April, for the first time for 12 years, but left the country before reaching maturity. Two swarms of mature adults appeared in November, when sporadic egg laying took place in several areas, and three or four swarms entered the Territory in December, but left without ovipositing. A successful hopper campaign was carried out in one locality in December.

Thrips tabaci, Lind., attacked pyrethrum plants in the Southern Highlands Province and caused darkening of the flowers, and, when numerous, silvering of the leaves and drooping of the plants. A fungus identified as *Cladosporium* sp. was associated with the blackening of the flowers. This thrips was present in onions but not abundant enough to injure them. There was a local increase in the area of sugar-cane infested with the Melolonthid, *Cochliotis melolonthoides*, Gerst., of which 2½–3 million larvae were collected from 159 acres after ploughing. *Campsomeris* (*Dielis*) *mansueta*, Gerst., was present, and plants with flowers that attract this Scoliid are being grown ; cotton appeared to be the most attractive. Maize and sorghum are attacked by *Busseola fusca*, Fuller, over most of the Territory, but in the coastal district *Proceras argyrolepida*, Hmps., takes its place. *Toxoptera graminum*, Rond., and *Aphis maidis*, Fitch, were found on wheat during a survey made in connection with the rapid expansion of this crop, but insect damage to it has so far been negligible.

Anthrenus pimpinellae, F., infested the horse-hair stuffing of railway carriage seats.

Smee (C.). **Report of Entomologist, 1943.**—11 pp. typescript. [Zomba, Dep. Agric.] Nyasaland, 1944.

With a few exceptions, insect pests were not abundant in Nyasaland in 1943. Infestation of cotton by *Platyedra gossypiella*, Saund., was negligible, but there was a rather severe outbreak of Jassids in the Lower River and Lake Shore areas. A single individual of *Apanteles earterus*, Wlkn., was bred from a larva of *Diparopsis castanea*, Hmps., collected on cotton in North Nyasa in November. Tobacco was seriously damaged by *Myzus persicae*, Sulz., particularly in parts of the Southern Province ; badly uprooted main crop tobacco, which produces a quantity of sucker growth, late tobacco grown by natives for their own use and *Gynandropsis pentaphylla* [*cf. R.A.E.*, A **31** 387] may prove to serve as food-plants during the off-season for tobacco, but native snuff tobacco (*Nicotiana* ? *rustica*) and the weed, *Cleome monophylla*, appeared to be of little importance. As the kromnek virus [*Lethum australiense* var. *typicum* of Holmes] was shown to be present in dahlia plants in South Africa and Southern Rhodesia, the importation of such plants and tubers from these countries was prohibited in 1943. The Limacodid, *Niphadolepis alianta*, Karsch, was less important on tea than it had been for three or four years [*cf.* **31** 353, etc.], but Psychids appeared to be increasing. *Paratetranychus* (*Tetranychus*) *bioculatus*, W. & M., was less abundant than was expected until after the break of the rains ; it was evident in some places in late January 1944. One section of an estate that was formerly severely infested by this mite has been comparatively free from it since the

plants have been shaded by *Grevillea robusta*. *Toxoptera aurantii*, Boy., was prevalent on tea early in the season of 1943–44, but it causes little damage and is controlled to some extent by Coccinellids.

Observations on tung trees (*Aleurites* spp.) indicated that Coccids [*cf.* **32** 286, etc.] are likely to be the most serious pests. *A. fordi*, which does not appear to thrive in Nyasaland, was considerably infested by *Pulvinaria jacksoni*, Newst., which is usually checked by Coccinellids, and *Ceroplastes ficus*, Newst., which is parasitised by species of *Coccidoxenus*. *A. montana* was attacked by *Pseudococcus adonidum*, L., which was widespread but apparently not of importance and was controlled by natural enemies at Zomba, and *P. perniciosus* Newst. & Willc., which was injurious to healthy trees, though more abundant on trees growing in poor soil or damaged by termites. *P. perniciosus* was effectively controlled by cutting off and destroying infested branches and washing off the smaller clumps of mealybugs with a strong jet of water. Records of natural enemies of the two species of *Pseudococcus* observed in 1941 and 1943, many of which have not been identified, are given in a table. Both were attacked by the Coccinellid, *Exochomus melanocephalus*, Zoubkoff (*nigromaculatus*, Goeze), and the Noctuid, *Eublemma costimacula*, Saalm., which was itself parasitised by *Apanteles leptothecus*, Cam.; *P. adonidum* was parasitised by *Anagyrus beneficians*, Comp., *Cheiloneurus carinatus*, Comp., and *C. cyanonotus*, Wtstn., and *P. perniciosus* by *A. aurantifrons*, Comp., *A. beneficians*, *Prochiloneurus clavatus*, Comp., and *C. cyanonotus*. No serious damage has been caused to tung by leaf-eating caterpillars, but *Taragama nyassanum*, Strand, and *Pachypasa sericeofasciata*, Auriv., have been collected on it; both these Lasiocampids also attack *Bridelia* trees, which are common in the Shire Highlands.

Cultivation of wheat is increasing, but few insect pests have been recorded from it. *Laphygma exempta*, Wlk., destroyed a few acres in Mlanje in April and *Macrosiphum avenae*, F. (*granarium*, Kby.) caused slight damage in the Cholo district. A stem-boring caterpillar, *Sesamia epunctifera*, Hmps., or *S. fuscifrontia*, Hmps., was moderately abundant on late crops in Cholo and at Zomba; it was not noticed on the earlier rain-grown crops in Cholo. Infested plants contained 1–48 larvae per stalk and were completely destroyed. Larvae collected in July and August pupated in cocoons a short distance below soil level, and the adults emerged in October. Larvae were also present in late wheat in September. *Busseola fusca*, Fuller, does not cause much damage to maize over most of Nyasaland, but is more injurious at altitudes above 4,000 ft.

Leguminous crops were severely attacked by *Ootheca mutabilis*, Sahlb., in January and February, and by *Mylabris dicincta*, Bertol., in April–June. Other insects recorded during the year included *Prodenia litura*, F., which occurred on flax in considerable numbers during May and June; the Notodontid, *Rhenea mediata*, Wlk., which defoliated *Trichilia emetica* in April [*cf.* **31** 353]; the Cetoniid, *Poecilophila* (*Porphyronota*) *maculatissima*, Boh., which damaged apple and plum trees in Limbe in January; the Hesperiid, *Rhopalocampta forestan*, Stoll, which was numerous on *Canavalia ensiformis* at Zomba from June to August; *Oecanthus brevicauda*, Sauss., which was common on cotton and tobacco; the Tenthredinid, *Athalia himantopus*, Klug, which did serious local damage to cruciferous vegetables; *Macrosiphum brachytarsus*, Ris Lambers, which became numerous on *Cajanus cajan* (*indicus*) at Zomba early in July; *Cinara* (*Dilachnus*) *thujafolia*, Theo., which was recorded for the first time from young plants of *Widdringtonia whytei* on Mlanje plateau forest reserve; *Asterolecanium pustulans*, Ckll., on cultivated fig; and *Diaspis echinocacti*, Bch., on *Opuntia*. It was found that *Omocena convergens*, Her., like other Limacodids, has a diapause in the final larval instar, its occurrence depending on the time of year at which the cocoon is formed. Adults emerged after 22 and 193–255 days from cocoons formed on tea in February 1941 and in June–July 1939, respectively; they emerged after 188 days from

cocoons formed on castor in June in 1939 and after 247 days from those formed on *Aleurites* in May 1942.

Nomadacris septemfasciata, Serv., was again the only locust present in the Protectorate [*cf.* **31** 353], and it bred only in the Southern Province. Hoppers from eggs deposited in November 1942 were largely destroyed by spraying with sodium arsenite, but prolonged oviposition until January and early February resulted in the presence of scattered hopper bands in some districts in February, March and April. Spraying was continued where possible, the natives were able to destroy or disperse the small bands in some areas, and severe damage to crops occurred only in two districts. Flying swarms developed during April and May, and normal movement away from the low altitudes took place. There were probably only 9–10 swarms in the Protectorate during the following months, and no swarms, oviposition or hoppers were reported from early October until the end of the year [*cf.* **32** 386]. It was subsequently ascertained, however, that a flying swarm had been seen in the Chiromo area (Lower River) early in December and scattered bands of hoppers were reported there in January 1944.

Progress Reports from Experiment Stations Season 1942–1943.—181 pp., 4 figs., refs. London, Emp. Cott. Gr. Corp., 1944. Price 3*s*.

The pests of cotton occurring at various Experiment Stations during 1942–43 are discussed as in previous years [*R.A.E.*, A **31** 387]. W. G. Wells (p. 15) gives a brief account of experiments against *Heliothis armigera*, Hb., in Queensland. A spray containing lead arsenate and molasses [**31** 30] caused marked increases in yield of non-irrigated cotton when timed to provide arsenical deposits during the main outbreak, but was ineffective on irrigated cotton that was rank and straggling in growth. This confirmed the view that the effectiveness of insecticides against *Heliothis* is correlated with plant type. The highest yields from cotton that was not treated against insects were obtained from mid-October sowings, but differences in yield could all be attributed to the suitability of the plants for development of *Heliothis* at the time of the main outbreak.

A report from Barberton, South Africa, by D. Macdonald, D. F. Ruston and H. E. King (pp. 18–36) includes the results of investigations of Jassid-resistance in hybrid material derived from *Gossypium hirsutum* × *G. barbadense* [*cf.* **31** 387]. Field estimates of the effect of Jassids on the plants and nymph counts both demonstrated a close connection between resistance and length and density of leaf hairs. Length appeared to be more important than density, and stem hairiness to be relatively unimportant. There were strong indications that hairiness is the direct cause of resistance.

G. S. Cameron (pp. 55–56) reports that although Jassids were not more abundant than usual in Southern Rhodesia, strains of cotton that were hitherto considered to be resistant were damaged. The American bollworm [*Heliothis armigera*] was unusually scarce, but the Sudan bollworm [*Diparopsis castanea*, Hmps.] was prevalent throughout the season and caused much loss of flowers and young bolls on late-planted cotton. Species of *Dysdercus* were very injurious. *D. intermedius*, Dist., was the most important from April onwards, *D. fasciatus*, Sign., being slightly less abundant and *D. superstitiosus*, F., scarce.

In reports from the Anglo-Egyptian Sudan, S. H. Evelyn (p. 61) records high Jassid resistance at the Gezira Research Farm in progenies of cotton plants selected for hairiness. R. L. Knight (p. 73) states that *Gossypium thurberi* at Shambat was not attacked by the pink bollworm [*Platyedra gossypiella*, Saund.], although surrounding plants were very severely infested, and that it remained uninfested when the surrounding cotton was removed.

R. R. Anson (p. 80) records severe damage to cotton seedlings at Kadugli by *Podagrica puncticollis*, Weise, which attacked them about a week after they

germinated. Fine ash sprinkled over the seedlings was fairly effective as a repellent. *Empoasca benedettoi*, Paoli, did not become injurious until the middle of September ; one variety of cotton was found to be very resistant to it.

J. D. Jameson (pp. 98–104) reports a close correlation at Serere, Uganda, between the height of cotton plants and damage by *Lygus simonyi*, Reut. ; both were increased by manuring with cotton seed or ash, particularly the former. When spread along the rows, cotton seed provided a breeding site for *Dysdercus* spp., and both *D. superstitiosus* and *D. nigrofasciatus*, Stål, were more numerous than usual. Cotton seed used as manure and as food for cattle in the open was also regarded as being partly responsible for an attack by *Oxycarenus*. The two varieties of cotton that were slightly more resistant to *L. simonyi* were also the most resistant to Jassids.

Reports are given from four districts in Tanganyika Territory. J. E. Peat (pp. 111–114) states that at Ukiriguru damage by Jassids and *Lygus* was noticeable only on cotton grown on heavy valley-bottom clay, but appreciable injury due to the former occurred on some plots in the surrounding district ; serious damage by both appears to be associated with wet years. In certain localities where plant growth was sappy, *Lygus* caused considerable loss of buds. No attack by *H. armigera* developed on cotton, and this may have been due to the ratooning of pigeon pea [*Cajanus cajan*] and late sowing of maize [*cf.* **31** 388]. *D. superstitiosus* and *D. nigrofasciatus* appeared on the cotton at Ukiriguru in April, and small numbers of *D. fasciatus* occurred later. Elsewhere, *D. fasciatus* was probably of greater importance in two districts, and *D. cardinalis*, Gerst., in one. *Calidea* was plentiful in some areas. Heavy infestation by Aphids on hill cotton at Ukiriguru early in the year stunted plant growth seriously.

A. N. Prentice (pp. 118–119) states that at the Lubaga Station, Shinyanga, and in the surrounding district, attack by *Dysdercus* spp. [*cf.* **31** 388] was lighter than usual until late in the season, and much of the staining was due to the Pentatomid, *Calidea dregii*, Germ., which was present from March until May. The percentages of bolls stained on cotton planted at Lubaga on five successive dates between early December and mid-February were 30, 37, 80, 89 and 100, respectively. In district plots, the percentage ranged from 13 to over 50, and was again rather less on early-planted cotton [*cf.* **31** 32]. The yield of seed-cotton from plots treated with a bait-spray of 1 oz. sodium arsenite and 2 lb. sugar in 1 gal. water applied weekly at a rate of 1–2 gals. per acre while stainers were present was 915 lb. per acre, of which 24 per cent. was stained, whereas the yield from the controls was only 518 lb. per acre, of which 52 per cent. was stained. The spray did not injure the plants, and it is not known whether it reduced *Dysdercus* or *Calidea* or both. Reduviids of the genus *Phonoctonus* were abundant and may have exerted some control of *Dysdercus*. *H. armigera*, *Earias insulana*, Boisd., and *E. biplaga*, Wlk., were unimportant. Aphids were unusually abundant on cotton and some severe bud-shedding in early March was attributed to them ; Coccinellid and Syrphid larvae appeared later than usual, but eventually destroyed the Aphids so that the crop recovered. Larvae boring in the stems of sorghum were identified as *Busseola fusca*, Fuller.

A. G. Bebbington (pp. 124–127) describes preliminary observations at two possible sites for a new experiment station at Kilosa, in the Eastern Province. *Heliothis armigera* (*Chloridea obsoleta*, F.) was present on maize throughout the area in February and March. Continuous records on maize at one of the sites and on maize planted on different dates at the other showed that only one generation occurred on each planting ; larvae were last recorded on maize in the middle of June. There were indications that late-planted cotton escaped attack to some extent. *Earias* spp. were present in varying numbers from May, when small numbers of *Platyedra gossypiella* also appeared. The latter was not again observed until late July, but was abundant in August and September. *Dysdercus intermedius* and *D. fasciatus* were the most plentiful of the stainers in the Kilosa area, but neither began breeding until the bolls opened ; *D. cardinalis*

and *D. nigrofasciatus* were of secondary importance, and *D. superstitiosus* was scarce. On an estate farther north, *D. cardinalis* was the most important species. Although the stainers were abundant only 20 per cent. of the main crop was damaged. *Helopeltis* was negligible on two commercial cotton crops, but reached a peak estimated at 220 per acre on experimental cotton in July ; damage was not severe and was mainly restricted to the vegetative parts of the plant. *Calidea* was uncommon. *Lygus* attacked the plants early in the season, but damage was not again noticeable until the end.

A. H. McKinstry (pp. 129–131) reports from the Morogoro district that since the bulk of the maize was most attractive to ovipositing females of *Heliothis* in April, when it was tasselling, it may be the source of some or all of the moths that attack cotton. Cotton planted in February was more severely damaged than cotton planted in March or April. The larvae were present in July on *Cajanus cajan*, which flowers at the same time as cotton and apparently does not influence populations on it. *H. armigera* was not observed on sorghum. In two experimental plots in different localities, Capsid damage was less severe on the hairiest varieties. Other pests of importance were spiny bollworms [*Earias*] and *D. cardinalis*.

E. O. Pearson (pp. 141–156) reports on investigations at Zomba, Nyasaland. Much of the work was concerned with the effects of controlled temperatures on the development of pupae of the red bollworm [*Diparopsis castanea*], and it is concluded from the results, together with previous ones on humidity [**32** 390], that the resumption of normal development in long-term (diapause) pupae [**31** 33] is not due to external stimuli as had been believed. Pupae obtained from field-collected, fifth-instar larvae were separated into three batches, which were kept, respectively, at medium temperatures (about 25°C. [77°F.]), high temperatures (37–38·5°C. [98·6–101·3°F.]) and alternating medium and high temperatures. After 13 weeks, a sample from each batch was kept at 30°C. [86°F.]. In all treatments some moths emerged within five weeks and these represented the short-term pupae, but little further emergence occurred until the 16th week, when the pupae exposed to 30°C. after 13 weeks of all treatments began to produce moths. Those maintained at about 25°C. began to emerge only slightly later than those at 30°C. It was evident that the pupal period of long-term individuals is largely predetermined in the larval stage, but that the rate of development is affected to some extent by the temperature to which the pupae are exposed, those maintained at 25°C. having had a mean period of 26 weeks and those changed to 30°C. one of 22 weeks. Low temperatures, continuous or alternating, did not induce short-term development ; they merely caused a retardation proportional to the length of exposure to them. Physiological change probably continues slowly throughout the pupal period. Continuous exposure to high temperature (37–38·5°C.) prevented emergence, and there may be a hormone that normally induces emergence on reaching a given concentration and is destroyed by heat. On being transferred to a constant temperature of 30°C., the development of pupae previously subjected to the high temperature was resumed and emergence occurred. The long-term pupal period probably comprises a quiescent phase of about three months during which the total duration of the pupal period is not affected by sub-lethal temperatures, a phase of slow development during which it is, and a phase of visible development corresponding in duration and appearance with the development period of short-term pupae at similar temperatures. In preliminary experiments to determine lethal temperatures, long-term pupae kept at 38·5°C. were not killed, although their development was inhibited, and others survived exposure to 41°C. for eight hours a day over a period of several months. Pupae kept at or above 50°C. [122°F.] after they had started to develop were killed, and six-weeks-old pupae were killed by exposure to 45°C. [113°F.] for 48 hours at relative humidities of 19 and 88 per cent. Temperatures of 8°C. [46·4°F.] did not appear to be lethal.

In short-term pupae, the rate of development varied directly with the temperature over a range of 22·5–33·5°C. [72·5°–92·3°F.], the longest observed duration being 31 days at 21·5°C. [70·7°F.]. The rate of change of velocity diminished above 33·5°C., the pupal period approaching a limiting value of about 11 days. Between 15 and 20°C. [59 and 68°F.], development is so slow that the pupae are generally killed by desiccation or moulds [*cf.* **31** 389]. It is arrested below 15°C., but may be resumed in a favourable environment; temperatures as low as 8°C. were not lethal. The highest temperature at which development took place was 36°C. [96·8°F.]; at 38°C. [100·4°F.] it was arrested, but could be resumed at more favourable temperatures, and at 41·5°C. [106·7°F.] the pupae were killed. Fully-fed larvae collected in April and placed in soil at different temperatures pupated normally over a range of 21·5–36°C., but there was a sharp fall in the number pupating successfully above and below these temperatures and none pupated at 16°C. [60·8°F.] or 41·5°C. The temperature during pupation did not affect the character of the pupae, all of them being short-term, as is usual at that time of the year.

Contrary to previous findings [**31** 390], which are regarded as erroneous, the mean pupal periods of long-term pupae removed from their cells and maintained at 30°C. and about 25°C. were shortened by four and five weeks, respectively, and a small reduction was also observed in the pupal period of naked short-term pupae [*cf.* **31** 33]. Emergence during the earlier months was significantly greater from naked pupae than from those in cells, and adults emerged almost continuously from naked pupae, with no marked distinction between individuals of short and protracted development. Since this was observed at constant temperatures, it could not be attributed to the protection of pupae in cells from small fluctuations in temperature; furthermore, measurements showed that even with temperature changes of the order of 3°C. [5·4°F.] per minute, the lag within the cell was not greater than 45 seconds. It is suggested that an excess of carbon dioxide and a deficiency of oxygen, sufficient to retard development, may be produced within the cell.

In the field, the percentage of short-term pupae was found to be 90–99 until mid-May, after which it declined to 35–40 in August and early September. In experiments to determine the factors causing prolonged development, larvae reared at constant temperatures of 23–33°C. [73·4–91·4°F.] produced short-term pupae whether fed on buds or green bolls and whether derived from eggs laid by moths with a long or short pupal period. Larvae reared on buds and green bolls at fluctuating temperatures or subjected to low or high temperatures also gave rise to short-term pupae; some pupae kept at 38°C. and derived from larvae fed on mixed food at 30°C. resumed short-term development only when returned to the lower temperature. In all three experiments, a few larvae gave rise to long-term pupae, indicating the operation of some genetic factor. The percentage mortality from the time when the larvae became fully-fed until emergence was 64·8 in 1941–42 [*cf.* **31** 389] and 68·9 in 1942–43. Loss from predators was much lower in the latter season, when, although weather conditions were fairly dry, the growth of the crop was better and afforded more cover.

Emergence in the field is discussed with reference to these investigations. The almost exclusive production of short-term pupae in January–March is attributed to the fact that the larvae then feed on green food at temperatures within the developmental limits. When short-term pupae are maintained at the temperatures experienced in the field in May–July, their development is prolonged, and this accounts for the occurrence in the field of overwintering pupae from which adults do not emerge until temperatures rise in August [**31** 32]. From May or rather earlier, the proportion of larvae producing long-term pupae rises steadily. Emergence from these takes place 3–9 months after pupation, with a peak at 5–6 months, but development may be inhibited by heat or flooding [**31** 33]. Possible alternative applications of these results to control

are discussed in some detail. They include minimising the carry-over of pupae from one season to the next by limiting boll-production to the time of year during which only short-term larvae are produced ; preventing the survival of the offspring of moths from long-term pupae by planting the crop later in the year or interplanting with cereals to retard its growth so that no food is available ; or planting early enough to enable a large part of the crop to be set before heavy populations are built up.

The rest of the work at Zomba was concerned with *Dysdercus fasciatus* and *D. intermedius*. Confirmation was obtained of previous findings regarding the temperature and humidity necessary for the development of the eggs and first-instar nymphs [**31** 390], the eggs depending mainly on temperature and the nymphs on humidity. It was found, however, that in soil débris in a dense thicket surrounding the base of *Sterculia appendiculata*, eggs developed and first-instar nymphs moulted throughout the hot, dry season (September–December), when breeding on other sites ceased. The percentage survival of the later nymphal instars of the two species under insectary conditions is given in a table. In both species, less than 50 per cent. survived the nymphal stage, and the total survival during the whole development period averaged 7 per cent. for the year ; as an average female lays about 70 eggs, it gives rise to only about five adults. The rate of survival varied considerably, however ; it was highest during the late rains and early dry season and lowest in the late dry season. In studies of seasonal populations on various trees, both species were recorded on *Adansonia digitata*, *S. africana*, *S. appendiculata*, *S. quinqueloba*, *Ceiba pentandra*, *Thespesia rogersii* and *Bombax stolzii*, but the last two are of little importance. *D. fasciatus* bred primarily on *A. digitata*, reaching peaks in March and May–June, and only to a small extent on *Sterculia* spp. *D. intermedius* was present in small numbers throughout the year on *A. digitata*, on which it reached a peak in January, and during most months on *S. africana* and *S. appendiculata*, on which peak infestations occurred in January and May–June ; it was present on *S. quinqueloba* during the fruiting period in late April, and reached a high peak in late May. One generation of stainers probably occurs on herbaceous food-plants before cotton becomes available.

B. L. Mitchell (pp. 156–162) gives an account of work in the Lower River area of Nyasaland. In the second half of February, when much of the crop was in the seedling stage, injury by Jassids to the growing leaves was so severe that some fields had to be replanted. By mid-April, however, infestation had decreased, and the young growth showed little evidence of attack. Cotton planted in February was not attacked to any extent. Infestation by *Diparopsis castanea* was very severe ; heavy and sustained oviposition by females of the diapause flight coincided with the fruiting period of the late-planted crop. In the area that suffered most, the mean rate of oviposition was 29,000–37,000 eggs per acre per week. Infestation by *Dysdercus*, which began while that by *Diparopsis* was still in progress, was heavier and more sustained than usual, but breeding was restricted by lack of bolls. In both 1942 and 1943, plots that were dug after the cotton was uprooted in July to facilitate the action of predators contained 33 per cent. fewer pupae of *D. castanea* in late October than those that were not ; there was no significant difference in the number of live pupae immediately after digging. Pupal mortality was studied as in the previous season [**31** 390] in a field cultivated normally and one in which weeds were allowed to persist. Mortality due to predators, notably rats, was slightly higher and survival lower in the clean cultivated field. Rats were most active in this field between April and July, whereas in the weedy field they caused considerable mortality after the cotton was uprooted. Field tests in which larvae were reared on bolls of known ages indicated that the nature of the larval food is not the determining factor in the production of long-term pupae.

O. J. Voelcker (pp. 166–167) states that attack by *Helopeltis* in southern Nigeria was severe, but that the damage was reduced by daily hand-collection.

Roebuck (A.) & Bray (S. P. V.). **Notes on the Abundance, Life-history and a teratological Specimen of *Hypnoidus riparius* F. (Col., Elateridae).**—*Ent. mon. Mag.* **80** p. 73, 2 figs. London, 1944.

Larvae of *Hypnoidus riparius*, F., are abundant in the upland pastures of Derbyshire, particularly at altitudes of over 800 ft. [*cf. R.A.E.*, A **32** 434]. The average number in 103 fields examined was 35,000 per acre, or 14 per cent. of the total wireworm population. As rearing tests indicated that only larvae in the last two instars are found, the real populations are much higher. It was found that the larvae moult twice during the summer (July–August) and pupate either in the winter (February–March) or summer (July–August).

Jacob (F. H.). **Notes on the Habits and Life-history of the Leaf-eating Brown Weevil, *Phyllobius pyri* L. (Col., Curculionidae).**—*Ent. mon. Mag.* **80** pp. 78–79, 4 refs. London, 1944.

In April 1942, adults of *Phyllobius pyri*, L., were found feeding on the leaves of winter wheat in a single field in Northumberland; as they were very numerous and there was little foliage in the hedgerows at the time, they had probably attacked the wheat for lack of other food. Pairs in pots containing growing wheat, oats, peas, lucerne or couch grass (*Agropyrum repens*) mated readily, but were not observed to oviposit; the wheat was eaten immediately, couch grass was eaten after 2–3 days' starvation and oats, peas and lucerne were not. Adults of this weevil have not previously been known to feed on wheat, but there are two records of possible damage to grass roots by the larvae [*R.A.E.*, A **13** 211; **24** 403], and in October 1942, three grass fields in Northumberland were found to have been severely damaged by them. Larvae, prepupae and pupae were numerous in the soil, chiefly at a depth of 4–6 ins., in October, but only pupae and a few larvae were present in January 1943. Samples of larvae and pupae were placed in pots, which were kept indoors or in the open throughout the winter. The pot indoors contained living adults on 28th December; those outside contained only larvae and pupae on 28th December, and living weevils and pupae on 16th March. These observations suggest that the pupae normally hibernate, though larvae are able to do so, and that the adults emerge about the middle of March, though the duration of hibernation depends to some extent on environmental conditions, particularly temperature.

Kloet (G. S.). **A new generic Name in the Coccidae (Hemiptera).**—*Ent. mon. Mag.* **80** p. 86. London, 1944.

The new name *Ovaticoccus* is proposed for the Coccid genus *Gymnococcus*, Douglas, as the latter name is preoccupied in Protozoa; Newstead's description of the generic characters is quoted. The genotype is *G. agavium*, Dgl.

Simmonds (H. W.). **The Effect of the Host Fruit upon the Scale *Aonidiella aurantii* Mask. in Relation to its Parasite *Comperiella bifasciata* How.**—*J. Aust. Inst. agric. Sci.* **10** no. 1 pp. 38–39. Sydney, 1944.

In experiments begun in Australia in January 1943, females of the Chinese race of *Comperiella bifasciata*, How. [*cf. R.A.E.*, A **31** 392] were kept at about 70°F. in jars containing either oranges or lemons infested with *Aonidiella aurantii*, Mask. The numbers that survived for two weeks were 43 out of 62 on oranges and 18 out of 62 on lemons, and the progeny per female averaged 11·5 and 4·4, respectively. When females were given the choice of infested oranges and lemons, the total progeny numbered 229 on oranges and only 22 on lemons. Further tests carried out until the end of November 1943 confirmed these results, the numbers of young per female being 6·4 on oranges and 3·3 on lemons when the insects were given no choice and 5·1 on oranges and 1·5 on lemons when there was choice.

The author concludes that lemon, as a food-plant for *A. aurantii*, has an inhibiting effect on the development of *C. bifasciata*, though the parasites reared from the Coccids on the lemon fruits were as large and developed as quickly as those from Coccids on oranges. As the female parasite appears to feed on the juices exuded by the host after it is punctured, these may have some effect on fertility or vitality, as suggested by the higher rate of survival on orange, although a honey jelly was supplied as additional food in all cases.

Bald (J. G.) & Helson (G. A. H.). **Estimation of Damage to Potato Foliage by Potato Moth,** *Gnorimoschema operculella* **(Zell.).**—*J. Coun. sci. industr. Res. Aust.* **17** no. 1 pp. 30–48, 4 figs., 7 refs. Melbourne, 1944.

During 1943, measurements of leaf area were made at regular intervals from 12th–16th February to 24th–25th March in a small plot of potatoes belonging to varieties commonly grown in Australia, by matching each leaf of the plants with photographic outlines of standard leaves that had previously been measured by planimeter. Serious infestation by *Gnorimoschema operculella*, Zell., was evident by the time of the last reading, and from this time the leaves were classified on a scale from 0 (negligible damage) to 5 (practically complete destruction) according to the amount of insect damage they had received. The standards taken were arbitrary, but to ensure consistency between estimates made at different times, photographs of plants falling within the classes represented by the different ratings were kept for reference. The uses and limitations of this method for estimating insect damage are discussed. It was found that the estimates were influenced by the habit of growth of the infested varieties, those with open foliage being rated higher than dense ones, because the damage could more easily be seen, and that they might also be influenced by growth conditions, having little to do with the number of larvae.

Significant differences in the reaction of strains and varieties to infestation were associated with differences in the rate at which leaf tissues destroyed were replaced by the growth of axillary shoots. There was no evidence that the insects preferred the leaf tissues of any one variety. The yield of infested plants was approximately proportional to the amount of leaf area left undamaged, and this provides a logical basis for this method of estimating insect damage.

Spiller (D.) & Turbott (E. G.). **The Occurrence of some Australian Insects and a Spider in New Zealand.**—*Rec. Auckland* [*N.Z.*] *Inst.* **3** no. 1 pp. 79–83, 19 refs. Auckland, N.Z., 1944.

The four insects here recorded from New Zealand include two, the Pentatomid, *Cuspicona simplex*, Wlk., and the Dynastid, *Heteronychus sanctae-helenae*, Blanch., that are potential pests. *C. simplex* was found on the leaves and fruits of *Solanum auriculatum* in September 1939 and subsequently at several places on *S. auriculatum*, *S. sodomeum* and tomato. It was very abundant in one locality, where it attacked the fruits of tomato as they were turning colour. *H. sanctae-helenae* was found at two places between March 1937 and December 1942, and adults caused considerable damage to the foliage of vegetables in December 1939.

Lagartas nocivas às gramíneas. [Caterpillars injurious to Graminaceae.]—*Biológico* **9** no. 12 pp. 411–414, 7 figs. São Paulo, 1943.

Outbreaks of *Laphygma frugiperda*, S. & A., and *Mocis repanda*, F., are common during the summer in the State of São Paulo, Brazil. Both species cause considerable injury to maize, rice and fodder grasses, and the former sometimes attacks cotton and the latter lucerne. Brief notes are given on the appearance of the larvae and adults of these moths and on their bionomics.

Outbreaks can be controlled by burning, rolling or spraying with an arsenical, and the migrating larvae can be checked and valuable plantings protected by means of trap ditches.

LEPAGE (H. S.). **A bróca do tomate** (*Leucinodes elegantalis* **Guén.**). [The Tomato Borer, *L. elegantalis*.]—*Biológico* **10** no. 2 pp. 42–46, 4 figs. São Paulo, 1944.

In 1939, tomatos grown in the State of São Paulo and destined for export to Argentina were found in Santos to be infested by the Pyralid, *Leucinodes elegantalis*, Gn., and the Argentine authorities subsequently refused to accept tomatos grown in Brazil unless they were certified in Santos to be free from infestation. Investigations were therefore made in São Paulo, and it was found that the moth was present over a large section in the east of the State. The duration of development from egg to adult depends on temperature and ranges from 40 to 60 days. The females lay their eggs near the calyx of the young fruits, and the larvae enter the fruits and feed on the pulp, the site of entry being later difficult to detect on account of its small size. When full-fed, the larvae leave the fruits and pupate among dry leaves and refuse on the ground or, if the fruit is boxed, on the sides of the boxes and in the straw used for packing. There are believed to be several generations a year, but the moth is not equally common in all years, and tomatos that are harvested in December and January are always less heavily infested than those picked in April or May. The wild food-plants are not known with certainty, but are thought to be Solanaceae.

The measures so far adopted in Santos have been to sort the fruit by hand and to fumigate it with carbon bisulphide, but the former method is slow and the latter causes premature ripening, so that the tomatos are liable to rot in transit. Effective measures of control to be applied before harvest are now being sought, and must obviously be directed against the eggs or the young larvae before they enter the fruits. It is recommended provisionally that wild Solanaceae should be removed from tomato fields and a spray of 20 oz. Paris green in 100 gals. Bordeaux mixture (10 : 10 : 100) applied every 20 days. The Paris green should be mixed with a little lime and water to make a paste before it is added to the Bordeaux mixture, directions for preparing which are included.

LEPAGE (H. S.) & FADIGAS jr. (M.). **A mariposa oriental das frutas** *Grapholitha molesta* (**Busck**). [The Oriental Fruit Moth, *Cydia molesta*.]—*Biológico* **10** no. 5 pp. 135–140, 5 figs., 20 refs. São Paulo, 1944.

Cydia (*Carpocapsa*) *pomonella*, L., and *Cydia* (*Grapholitha*) *molesta*, Busck, which reached Uruguay from Argentina, spread from Uruguay a few years ago to the State of Rio Grande do Sul, in southern Brazil, and, at the end of 1943, *C. molesta* was observed in the City of São Paulo. Investigations showed that it was present on peach in several localities near the city and also on quince in one of them. Notes on its life-history in the United States are given. In São Paulo, females of the overwintered generation appeared in August and oviposited on the young shoots and fruits. It is not certain that the first-generation are restricted to the shoots, as they are in the United States, but some larvae of the second generation were observed to migrate from the shoots to the fruits, which they entered through the side. The duration of the egg stage averaged 7·0, 5·4 and 3·1 days for the first three generations, respectively, and 8·3 days for the fourth and fifth. Unfed larvae survived for 10 hours after hatching. The period from the beginning of cocoon formation to pupation lasted 2–9 days, and the pupal stage 5–12 days. The larva, pupa and adult are briefly described.

A spray of 5 lb. lead arsenate and 1·5 gals. miscible oil in 100 gals. water has given good results in Uruguay against the eggs and newly hatched larvae, but is

considered to be too strong for conditions in São Paulo. Other measures include clipping infested twigs and applying trap bands to the trunks to attract larvae seeking sites for pupation.

Ephialtes (*Calliephialtes*) *argentinus*, Blanch., *Cremastus rubeo*, López Cristobal, and *C. flaviventris*, López Cristobal, parasitise the larvae in Argentina [*R.A.E.*, A **30** 277], and *Macrocentrus ancylivorus*, Rohw., does so in the United States, where *Trichogramma minutum*, Ril., is the only parasite that completes its development in the eggs, and *Aenoplex betulaecola*, Ashm., is the commonest parasite of the pupae. *M. ancylivorus*, *Glypta rufiscutellaris*, Cress., and *Ascogaster quadridentata*, Wesm., have recently been introduced into Uruguay from the United States against *Cydia molesta*, but have not so far been very effective, and though damage there has been much reduced since 1940, this is attributed to the parasite *Dibrachys cavus*, Wlk., which has become established and has spread to Rio Grande do Sul, in Brazil. Several native parasites of *C. molesta* are present in Uruguay, and one of them, *Trichomalus trujilloi*, Blanch. [which is considered to be identical with *D. cavus* by Gahan (**30** 597)] is being studied for use in biological control.

Monte (O.). **Uma lepidobroca da couve.** [A Lepidopterous Borer of Cabbage.] —*Biológico* **10** no. 5 pp. 141–144, 2 pls. São Paulo, 1944.

Brief descriptions are given of all stages of the Pyralid, *Hellula phidilealis*, Wlk., which has recently caused considerable damage to cruciferous crops in two localities in São Paulo. Cabbage was the most severely injured, but cauliflower, broccoli and rape were also attacked. The eggs are laid on the leaves, and the larvae feed for a few hours on the tender parts of the leaves and then enter the main stem, usually at the point of insertion of the leaf-stalks. They tunnel in the stems and usually kill young plants. Fungi also enter at the site of attack. Pupation occurs in the soil. In the laboratory, the egg, larval and pupal stages lasted 4–5, about 14 and 10 days, respectively. Control is difficult, since the larvae feed outside the plants for so short a time and it is dangerous to apply arsenicals to the parts destined for eating. They can, however, be applied to young rape and cauliflower. Infested plants should be removed and burnt, and cultivation of the soil destroys many of the pupae. Some control is afforded in Rio de Janeiro by *Bracon* (*Microbracon*) *hellulae*, Costa Lima [*R.A.E.*, A **30** 585].

Molestina O. (E.). **Indice preliminar de las principales enfermedades y plagas de la agricultura en el Ecuador.** [A preliminary Index of the principal Diseases and Pests of Agriculture in Ecuador.]—*Bol. Dep. Agric. Ecuador* no. 15, 25 pp., 10 figs. Quito, 1942.

A list of insects and a few mites that attack the more important agricultural crops in Ecuador, arranged under their food-plants, constitutes about half this bulletin. In some cases, brief indication is given as to the severity of the damage caused. Several insect pests of stored products are recorded in a final note.

Rodriguez Lopez (L.). **La "Iceria" plaga de los cítricos.** [*Icerya*, a Pest of Citrus.]—*Bol. Dep. Agric. Ecuador* no. 17, 10 pp., 2 figs. Quito, 1942.

An outbreak of *Icerya montserratensis*, Ril. & How., occurred a few years ago on *Citrus*, particularly orange, at Ibarra, northern Ecuador, and infestation spread to many garden and wild plants. Brief notes on the appearance and habits of this Coccid are given. Its life-cycle lasted 3–4 months, so that there may be 3–4 generations a year. Contact insecticides are largely ineffective against it, on account of its waxy covering. It is parasitised by *Cryptochetum iceryae*, Will., an Agromyzid that develops from egg to adult in about a month.

A consignment of *Rodolia cardinalis*, Muls., was obtained from California in February 1941, and liberations were made, as a result of which the outbreak was completely controlled. Total development of this Coccinellid occupied about three weeks.

TELFORD (H. S.). **White-footed Mice feeding upon Grasshopper Eggs.**—*J. Mammal.* **24** no. 3 pp. 440–441. Baltimore, Md., 1943. Repr. in *Bi-m. Bull. N. Dak. agric. Exp. Sta.* **6** no. 4 p. 18. Fargo, N. Dak., 1944.

The stomach contents of 11 examples of *Peromyscus maniculatus osgoodi* trapped in North Dakota in April were examined, following a report that this mouse, which is common in western North Dakota, seeks for and consumes the egg-pods of locusts, and three were found to contain eggs of *Melanoplus differentialis*, Thos. The mice had evidently fed on the egg-pods and not on gravid females, since no adult remains were found and gravid females are not normally present so early in the year.

TELFORD (H. S.) & MUNRO (J. A.). **Toads feed upon Sweet Clover Weevils.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **6** no. 4 pp. 35–37, 4 refs. Fargo, N. Dak., 1944.

Bufo cognatus and *B. americanus* feed on a variety of insects in the United States, and observations by A. N. Bragg in Oklahoma indicated that they are of great value in destroying cutworms in early spring, when these are almost the only insects available. *B. cognatus* is the commonest toad in North Dakota, where it has been abundant in recent years owing to increased rainfall. Its feeding habits in the latter State were investigated because it was observed to be destroying adults of *Sitona cylindricollis*, Fhs., which has recently become a pest of sweet clover [*Melilotus*] there [*R.A.E.*, A **31** 205]. Examination of the stomach contents of 74 specimens varying in length from 1 to 2¼ ins. and collected in and near fields of sweet clover between 29th July and 11th August 1943 showed that insects comprised over 99 per cent of the organisms found in them, and adults of *S. cylindricollis*, adults and larvae of other Coleoptera, ants and *Gryllulus* (*Gryllus*) *assimilis*, F., represented 58·9, 17·1, 15·2 and 2·8 per cent., respectively. The total number of adults of *S. cylindricollis* in the 74 toads was 1,407, and the maximum in one toad was 130. Many of the weevils were light in colour and had evidently only recently emerged. In the plots at one of the places where the toads were collected, the weevils were ten times as numerous towards the end of July when their numbers reached a peak, as on 7th August. The toads were numerous throughout the summer and may have caused the sudden reduction in numbers of weevils.

SMITH (C. F.). **The Aphidiinae of North America (Braconidae : Hymenoptera).**—9×6 ins., xii+154 pp., 17 pls., 12 refs. Columbus, Ohio State Univ., 1944. Price $3.50.

In this revision, the author regards *Lysiphlebus*, Först., and *Protaphidius*, Ashm. (*Coelonotus*, Först.) as subgenera of *Aphidius*, Nees, and erects two new subgenera in this genus. The many new species described include the following, all from the United States : *Praon aguti* reared from *Macrosiphum* (?) *rosae*, L., and *M. solanifolii*, Ashm. ; *Aphidius nigriteleus* from *Myzus persicae*, Sulz., in a greenhouse ; and *A. rosaphidis* from *Capitophorus* sp. on strawberry and *C. potentillae*, Wlk., on rose.

PAPER NOTICED BY TITLE ONLY.

TURNBULL (J.). **Orchard Spraying for commercial Growers** [in Britain].—*Growmore Bull. Minist. Agric.* no. 9 (revd.) 15 pp., 2 pls., 2 figs., 4 refs. London, H.M.S.O., 1944. Price 4*d*. [*Cf. R.A.E.*, A **32** 73.]

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